Forest Insect and Disease Conditions in Canada 1984

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Cover: FIDS – LFRC Ranger Jean-Pierre Bérubé inspecting a white spruce for pest symptoms.
Photo by Jacques Morissette

Forest Insect and Disease Conditions in Canada 1984

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Introduction

In 1981, the report of the Forest Insect and Disease Survey for 1980 was published in a new format with a new title, *Forest Insect and Disease Conditions in Canada 1980*, replacing the *Annual Report of the Forest Insect and Disease Survey* published since 1951. The new format was selected to reflect the changing emphasis of the Survey toward those insects and diseases that are likely to significantly affect the forest economy or environment.

In cooperation with those responsible for improving forest inventory and economic impact data in Canada, the Survey is attempting to provide more quantitative and interpretive data on damage and depletion caused by forest pests. This new initiative requires the development of methodologies and procedures before complete and accurate data can be made available. As forest management intensifies and the old, naturally growing forests are gradually replaced by new, managed forests, new pest problems and impacts of a different type will arise and require increased attention. Accordingly, our regional and national reporting will continue to be modified to reflect the changing activities and findings of the Survey.

In the 1981 report, estimates of the average annual depletion caused by important pests for the period 1977–81 were given and the limitations associated with these "best available estimates" were stressed. It is the intention of the Survey to compile similar depletion estimates at 5-year intervals. Meanwhile, the Canadian Forestry Service, in conjunction with provincial agencies, is exploring ways to correct deficiencies in these data so that information can be compiled that is indicative of the relative impacts of significant problems in the forests of Canada. Quantitative estimates of the loss caused by individual pests will be reported, however, as they become available.

Periodically, the Survey has selected certain forest problems that are of national interest to be highlighted in the annual report. In 1984, a new section on the Acid Rain — National Early Warning System has been added.

In this report, pests considered to be currently most significant in terms of their present or potential economic or environmental impact are described in detail under "Major Forest Insects and Diseases." Regional surveys of pest problems in special situations or of specific pests are summarized under "Special Surveys." The status of many other pests is presented in tabular form by region under the title "Other Insects and Diseases." This section has been expanded in 1983 and 1984 to reflect the importance of these pests. Although they do not, in most cases, have spectacular effects they are important because of their potential for expansion, quarantine considerations, and as vectors and indicators of other problems. Also, in some cases, they create losses due to their insidious nature. Additional information on the pests included, as well as information on other pests, can be obtained from the regional forest research centres of the Canadian Forestry Service at the addresses listed in page ii.

In addition to those cooperators named, we would like to acknowledge the numerous others who have provided information, including the field and laboratory staffs of the forest research centres, officers of provincial and federal governments and agencies, the forest industry, and private individuals, and to specifically acknowledge the assistance provided by the Scientific and Technical Publications Division in the editing and preparation of this report. Finally, we would like to thank those who provided us with comments and suggestions on previous reports.

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Major Forest Insects and Diseases

Spruce Budworm

Choristoneura fumiferana (Clem.)

The total area of defoliation caused by the spruce budworm decreased quite dramatically in 1984. However, this insect still must be considered the most destructive pest in Canada.

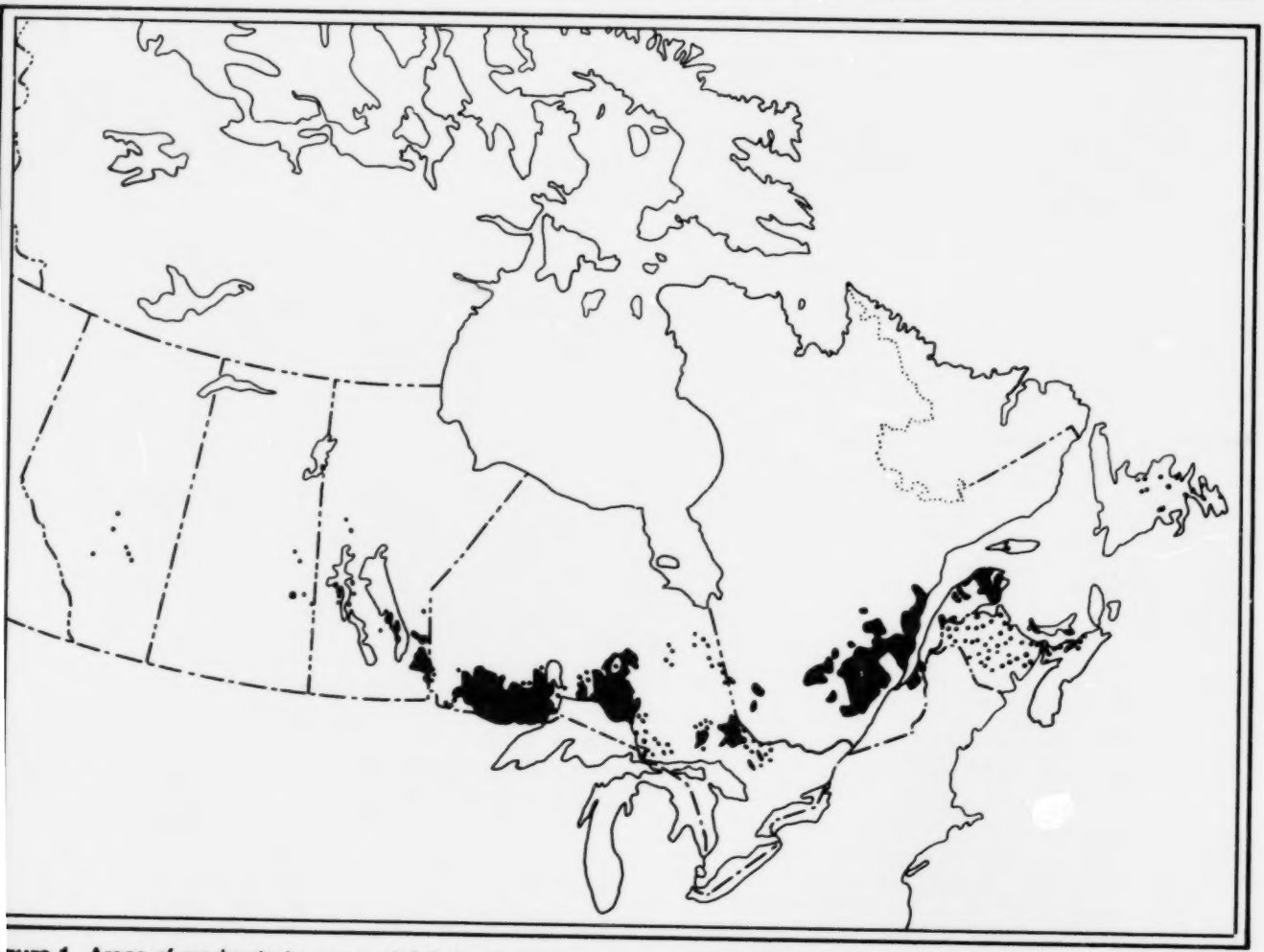
Balsam fir is the preferred host of the spruce budworm although it feeds heavily on red spruce, white spruce, and to a lesser extent on black spruce. At very high population levels, the spruce budworm will attack hemlock and tamarack.

In some areas, populations of other insects such as the spruce beetle and the eastern larch beetle have increased rapidly in stands weakened by repeated budworm defoliation and in turn, have themselves attacked and killed trees. These insects are discussed elsewhere in this report.

The area within which moderate-to-severe defoliation of fir and spruce occurred in 1984 was about 16.8 million ha (Fig. 1). Moderate-to-severe defoliation is defined as 30% or more of current foliage removed. Although a complete survey for dead and dying trees was not conducted in 1984, it is estimated that the total area of tree mortality would not differ greatly from the 1983 figure which was estimated at 26.5 million ha. Aerial spray operations were carried out in Newfoundland, Nova Scotia, New Brunswick, Quebec and Ontario, and covered a total area of 1.97 million ha (Fig. 2). Forecasts for 1985 indicate that the overall area of moderate-to-severe defoliation will increase dramatically. The status of the spruce budworm by province is shown in Table 1.

Newfoundland

Defoliation — The area of moderate and severe defoliation forecast for 1984 on the Island was 55 000 ha with an additional 81 000 ha in the light category, distributed mostly in western Newfoundland. The cool wet



gure 1. Areas of moderate-to-severe defoliation by the spruce budworm in Canada.

Table 1. Spruce budworm: Estimates of defoliation, tree mortality, and sprayed areas in 1984

Province	Area of moderate to severe defoliation ('000 ha)	Area of tree mortality ('000 ha)	Average annual mortality volume 1977–81 (million m^3)	Area sprayed ('000 ha)
Newfoundland	15.3	458†	3.7	26.3
Prince Edward Island	15.1	30†	—*	0
Nova Scotia	58.7	800†	3.1	20.5
New Brunswick**	730.0	1 000†	4.6	1 245.5
Quebec	7 100.0	12 085†	14.8	709.1
Ontario	8 747.8	13 516	11.6	3.7
Prairie Provinces	170.0	0	0	0
Total	16 836.9	27 889	37.8	2 005.1

* Data not available.

** Volume and area data were obtained from *New Brunswick Forest Inventory Data, 1981* and some of data used in estimating damage were obtained from *An Assessment of Damage Caused by the Spruce Budworm on Spruce and Balsam Fir Trees in New Brunswick, 1981.*

† These numbers are based on 1983 data.

Figure 2. Areas within which aerial spray operations were carried out against the spruce budworm in eastern Canada.

weather in June delayed larval development by about two weeks in comparison to 1983 and many of the patchy infestations collapsed. The total area of moderate and severe defoliation in 1984 was about 15 300 ha with 7 300 ha in the light category, a decrease from the 68 000 ha and 32 000 ha respectively in 1983 (Fig. 1). In Labrador the small infestation collapsed.

Spruce budworm larvae were collected weekly in 1984 and were reared in the laboratory to determine percentages of parasitism and disease. The major larval parasites were *Apanteles fumiferanae* and *Glypta fumiferanae* and the most common pupal parasite was *Phaeogenes hariolus*. About 11% of the spruce budworm sampled were parasitized. Fungal diseases caused less than 1% mortality of the reared larvae and the most common fungal pathogen was *Paecilomyces farinosus*.

Damage — Traditionally the Forest Insect and Disease Survey reported tree mortality in forest stands. During the past four years this assessment was conducted jointly with the Inventory Section of the Provincial Department of Forest Resources and Lands. In 1984 the Provincial Department was solely responsible for this work. Detailed reports have not been issued but aerial and ground observations indicate that the areas of tree mortality did not increase in 1984. The total volume of balsam fir and black spruce stands with more than 10% tree mortality remained at 40.4 million m^3 and 10.3 million m^3 respectively.

Control — The Provincial Department of Forest Resources and Lands treated about 23 200 ha with Matacil® and 3 110 ha with *Bacillus thuringiensis*.

Forecast — The areas of light, moderate and severe defoliation for the Island in 1985 are forecast to be about 63 000 ha. Moderate and severe defoliation is expected to be about 29 300 ha distributed in isolated areas throughout western Newfoundland and one area in the central part of the Island. Light defoliation is forecast to occur on about 24 000 ha, all in western Newfoundland. The infestation in Labrador collapsed this year and no defoliation is expected in 1985.

Nova Scotia

Defoliation — Defoliation of balsam fir and spruce in softwood and mixedwood stands occurred in 85 100 ha in Nova Scotia in 1984. Defoliation was severe on 25 900 ha, moderate on 32 800 ha, and light on about 26 400 ha. The 58 700 ha of moderate and severe defoliation is a substantial decrease from the 294 000 ha so affected in the province in 1983. The previously identified outbreak areas are discussed briefly to provide for historical continuity in reporting.

In Colchester-Cumberland counties the area of severe and moderate defoliation decreased to 30 200 ha in 1984 from 177 500 ha in 1983.

In the Northumberland Strait coast area of Pictou and Antigonish counties defoliation was severe or moderate on 21 500 ha in 1984 compared to 54 700 ha so defoliated in 1983. This was the smallest area affected since 1981 when 12 600 ha were in the severe or moderate defoliation categories.

In the Annapolis Valley-Hants County area there was no defoliation recorded in the severe or moderate categories in 1984. There was 44 000 ha of severe or moderate defoliation in 1983. Previous to that, in 1982, only 4 100 ha of moderate defoliation occurred in this area.

On Cape Breton Island there was no defoliation recorded in the severe or moderate categories in 1984. This compares with 17 700 ha of defoliation in 1983 and 400 ha of moderate defoliation recorded in 1982. However, in many of these areas tree mortality previously was in excess of 75% and defoliation occurred on the residual surviving trees, mostly white spruce and occasionally black spruce.

Damage — Damage surveys were not conducted in Nova Scotia in 1984. In 1983 an estimated 1.4 million m^3 balsam fir and 0.5 million m^3 spruce died as a result of repeated defoliation by spruce budworm and attacks on spruce by the spruce beetle. This amount of annual wood loss is expected to gradually decrease as the effects of the massive defoliation in the late 1970s and early 1980s diminish in the most severely affected areas; there are fewer and fewer trees left to succumb in these areas.

Mortality of merchantable balsam fir has been studied on permanent research plots in both the highland and lowland areas of Cape Breton Island since 1976. Although spruce budworm populations have decreased drastically since the height of the outbreak, losses continued to mount; many of the weakened trees have fallen victim to a complex of secondary organisms, and in recent years to blowdown.

In the highlands, 83.3% of the original trees had been lost by the fall of 1984, 69.2% to mortality and 14.1% to blowdown. The increase in total losses from 1983 was 6.4%. In the lowlands, where losses were much lower at the beginning of the outbreak, mortality has accelerated during the past few years. Mortality and blowdown in 1984 amounted to 92.4% on the research plots, compared to 90.4% in 1983. The apparent slowdown in losses is a classical case of "not much left to die" at these levels of stand destruction.

Control — Control operations against the spruce budworm were conducted by Nova Scotia Department of Lands and Forests. In 1984, 20 537 ha were treated in the province. Although there were treatment areas in Cumberland, Colchester, Pictou, and Kings counties, 96% of the treated area was located in Cumberland County. All treatment was with the biological insecticide *Bacillus thuringiensis* which was applied at either 20 BIU/ha or 30 BIU/ha. All but 1% of the treated area received a single application.

Forecast — Based on predictive surveys, both egg-mass and L2 surveys, the Nova Scotia Department of Lands and Forests expects most of the severe and moderate defoliation to occur in Cumberland, Colchester, Pictou and Antigonish counties, primarily along the Northumberland Coast. A significant increase is

predicted in both the area affected and in the intensity of expected defoliation within the areas so affected. Moderate defoliation is expected to occur in a small area of Kings County with light defoliation in other areas of the province.

Prince Edward Island

Defoliation — Defoliation of balsam fir and spruce stands occurred on 15 600 ha in Prince Edward Island in 1984 (Fig. 1), less than half of the 43 400 ha affected in 1983 and almost identical to the 15 300 ha defoliated in 1982. Defoliation was classified as follows, with the 1983 figures in brackets: severe on 8 200 ha (8 500 ha), moderate on 6 900 ha (13 700 ha) and light on 500 ha (21 200 ha). Severe and moderate defoliation occurred mainly in eastern Prince County, in southern Queens County, and southwestern Kings County.

Damage — Damage surveys were not conducted in the province in 1984. However, because of the decrease in spruce budworm-caused defoliation and also in the activity of the spruce beetle (see report on spruce beetle) the damage figures given for the province in 1983 should represent a maximum loss for 1984. Last year it was stated that "an estimated 60 000 m^3 balsam fir and 80 000 m^3 spruce died in Prince Edward Island in 1983 at a result of repeated defoliation by spruce budworm and attacks on spruce by the spruce beetle."

Control — No control measures on an operational scale were carried out against the spruce budworm in Prince Edward Island.

Forecast — Egg-mass surveys were replaced by L2 surveys in 1984 to provide predictions for 1985. Overwintering spruce budworm populations were high in 58%, medium in 33% and low in 8% of the locations sampled. A significant increase is expected in the area of defoliation in 1985. Severe defoliation is likely to occur in all three counties of the province.

New Brunswick

Defoliation — Defoliation of balsam fir and spruce stands was recorded as severe and moderate over 730 000 ha in the province in 1984 (Fig. 1). Inclement weather before and during the aerial survey period resulted in a considerable amount of reddened foliage having been washed off the trees. This, in turn, necessitated extensive ground surveys to supplement aerial survey information. Because of these difficulties it was necessary to combine the severe and the moderate defoliation categories and impossible to determine the area where light defoliation occurred. Consequently, the "traditional" area of total defoliation was unavailable.

The 730 000 ha severe and moderate defoliation caused by the spruce budworm in 1984 represented a significant decline from the 2 028 000 ha recorded in these categories in 1983.

Damage — There were no specific surveys conducted in 1984 by either the New Brunswick Department of Natural Resources or the Forest Insect and Disease Survey. Tree mortality as a result of repeated spruce budworm defoliation occurred over undefined areas of susceptible forest throughout the province. However, given the decrease in defoliation in 1984, it is likely that the rate of mortality in 1984 did not increase over previous years.

Control — Foliage protection against the spruce budworm in New Brunswick was conducted over 1 245 500 ha in 1984, 1 030 500 ha by Forest Protection Ltd., Fredericton, and 215 000 ha by Forest Patrol Ltd., a subsidiary company of J.D. Irving Ltd., Saint John, N.B. Forest Protection Ltd. treated 488 600 ha with fenitrothion, most of it with a double application of 210 g/ha and some small areas with single applications of either 210 or 280 g/ha. Aminocarb (Matacil®) was used over 504 600 ha, of which 117 800 ha were treated once at 90 g/ha and 386 800 ha treated twice at a dosage of 70 g/ha per application. Both chemicals were applied in water-based formulations. The bacterial insecticide *Bacillus thuringiensis* (Thuricide 48LV®) was applied undiluted to 37 300 ha at a dosage of 30 BIU/ha in a single application. Forest Patrol Ltd. treated 215 000 ha with fenitrothion with two applications.

Forecast — Egg-mass surveys were conducted at 1 476 points in the province in 1984. Population levels of spruce budworm were forecast to be high to very high at 27%, moderate at 22%, and low at 51% of the locations sampled. These results indicated that moderate-to-severe infestations might be expected over 3.57 million ha in New Brunswick in 1985.

Quebec

Defoliation — The active infestation covered 11.2 million ha (13.2 million ha in 1983). The area of severe defoliation totalled 4.7 million ha — a decrease of 55% from 1983 (10.5 million ha). Moderate and light defoliation totalled 2.4 and 3.9 million ha respectively.

In western Quebec, affected areas increased by 200 000 ha. The sectors most severely hit were the vicinities of Val d'Or and Lake Kipawa.

In central Quebec and on the North Shore, significant defoliation (moderate-to-severe) continued south of the Gouin Reservoir and from the longitude of Montreal to Baie-Comeau, with the exception of the Laurentides Reserve, where the infestation was generally light. In the Saguenay–Lac-Saint-Jean area, severe defoliation increased by 500 000 ha in relation to 1983.

In southeastern Quebec, defoliation was most often light in very small infestations in the census divisions of Lotbinière, Beauce and Mégantic. Moderate defoliation was recorded in the census divisions of Dorchester and Bellechasse. Defoliation was light-to-moderate throughout the Lower St. Lawrence as far as the Cascapédia River in the Gaspé, and was most often moderate east of Gaspésie park.

Control — The Quebec Department of Energy and Resource's aerial spraying program continued over 709 106 ha, 74% of which were in the Lower St. Lawrence–Gaspé area, 13% in the Quebec City area, 2% in the Saguenay–Lac-Saint-Jean area and 11% on the

North Shore. Chemical insecticides were used over 326 097 ha (46% of the treated area); these were Matacil® (80%) and fenitrothion (20%). The remaining 383 009 ha (54%) were treated with *Bacillus thuringiensis* (Dipel® 132 and 176, Thuricide® 32 LV, 48 LV and 64 B, and a new isolate, NRD-12).

Forecast — The number of egg masses surveyed was sufficiently high to cause us to expect severe defoliation in the areas of Montreal, Trois-Rivières, Quebec City, Saguenay–Lac-Saint-Jean and the North Shore. In the Abitibi-Témiscamingue area, the Outaouais and the Eastern Townships, light defoliation is forecast. In the Lower St. Lawrence–Gaspé area, patches of severe defoliation are expected amid generally light defoliation.

Ontario

Defoliation — The total area of moderate-to-severe defoliation declined by approximately 292 000 ha to 8.7 million ha in 1984. All of this decline occurred in northeastern and southern Ontario where the areas of moderate-to-severe defoliation now stand at 4.0 million and 73 000 ha, respectively. These declines were somewhat offset by an increase of 2.5 million ha in northwestern Ontario where the total area of moderate-to-severe defoliation is now 4.6 million ha.

Damage — The total mapped area of budworm-caused mortality of balsam fir and white spruce increased by 1.4 million ha to 13.5 million ha. Most of the increase occurred in northeastern Ontario where mortality now occurs in an area of 11.7 million ha. Small increases totalling 50 447 ha occurred in northwestern Ontario bringing the total in that area to 241 000 ha. Area of tree mortality in southern Ontario was unchanged at 1.6 million ha.

The total volume depletion due to tree mortality in 1984 is estimated at 7.918 million m^3. This consists of 5.858 million m^3 basam fir, 0.971 million m^3 white spruce and 1.089 million m^3 black spruce. The largest increase occurred in northeastern Ontario with a small increase in northwestern Ontario and no change in southern Ontario.

Control — The Ontario Ministry of Natural Resources carried out aerial spraying operations against the spruce budworm on 3 697 ha of commercial and high-value forest. Various formulations of *Bacillus thuringiensis* were used on 3 097 ha; aminocarb (Matacil®) was used on 400 ha and carbaryl (Sevin®) in the form of Sevin-4-Oil® was used on 200 ha.

Forecast — Egg surveys revealed an overall decline of 15% in egg densities. Most of the decreases occurred in northeastern and southern Ontario where the area of moderate-to-severe defoliation is expected to continue to decline in 1985. Substantial increases in egg densities were again recorded in northwestern Ontario. Corresponding increases in the area of moderate-to-severe defoliation are expected in that part of the province in 1985.

Manitoba

In 1984, moderate-to-severe defoliation occurred over a total area of 153 000 ha of white spruce – balsam fir forests in several locations in the province, compared to 40 500 ha in 1983. Balsam fir mortality is high in two areas that have been infested since 1976. No control program was conducted in 1984. Egg-mass counts and pheromone trapping indicate that medium-to-high spruce budworm populations will occur in these areas in 1985.

Saskatchewan

The outbreak detected in 1982 in the east-central part of the province decreased in intensity in 1984. Moderate-to-severe defoliation occurred over 4 800 ha of predominantly white spruce. In north-central Saskatchewan moderate-to-severe defoliation occurred over 7 900 ha, which was similar to the area affected in 1983. Timber harvesting was redirected to these two areas in 1984 to remove trees before the spruce budworm damage increased; this strategy might be responsible for any decline in budworm populations. Two new areas of infestation, not previously reported, were mapped and ground checked in 1984. These two areas in central Saskatchewan sustained light-to-moderate defoliation over 1 000 ha and 1 400 ha, respectively.

Alberta

The spruce budworm was again responsible for varying degrees of damage in several white spruce stands in central Alberta. Moderate-to-severe defoliation occurred in six widely scattered areas ranging in size from 50 ha to 300 ha. Light-to-moderate defoliation occurred in three other areas including Edmonton. Four of these areas of infestation were sprayed with *Bacillus thuringiensis* (Dipel® 88) with limited success.

Egg-mass counts indicate that medium-to-high spruce budworm populations will occur in 1985 within the infested areas in the prairie provinces.

British Columbia

A new outbreak lightly defoliated current year's needles of valley bottom alpine fir and white spruce over 7 300 ha between km 790 and 863 on the Alaska Highway west of Liard Hot Springs. Defoliation is expected to intensify in 1985, but not expand significantly beyond the area affected this year. Repeated severe defoliation in the area during outbreaks between 1957 and 1977 resulted in tree mortality, top kill and growth loss.

Northwest Territories

Moderate-to-severe defoliation of white spruce forests occurred along the Liard River and its tributaries, from the British Columbia – NWT border to about 30 km east of Nahanni Butte. This represents an increase over the 10 600 ha estimated in 1983. Moderate-to-severe defoliation also occurred on Long Island and the adjacent valley of the Slave River, about 105 km north of Fort Smith, and was similar to that reported in 1983.

Western Spruce Budworms

Choristoneura spp.

About 62 000 ha of Douglas-fir forests in the southwestern interior of British Columbia were defoliated by the western spruce budworm, *Choristoneura occidentalis* Free. This is a slight decrease from 1983. Outbreaks in the Cache Creek-Ashcroft-Savona areas declined significantly following 10 to 12 years of moderate and severe defoliation. To the east of these stands, however, mainly light or moderate defoliation occurred over 43 000 ha in the Kamloops Lake-North Thompson River area in the Kamloops Region. In the adjacent Cariboo Region, outbreaks near Clinton expanded slightly to 18 800 ha of mostly light and moderate defoliation with pockets of severe defoliation. Light defoliation over 100 ha near Rock Creek in the Nelson Region occurred for the seventh consecutive year.

The number of moths in pheromone-baited traps and egg-mass surveys indicate continuing populations with moderate-to-severe defoliation of Douglas-fir stands in the Cariboo and Kamloops regions, and light defoliation in the Nelson Region.

Repeated moderate and severe defoliations have killed up to 8% of the mixed-age classes of Douglas-fir trees. Leader mortality and branch dieback occur on up to 50% of the understory trees near Savona, Cache Creek, Spences Bridge, and Clinton.

The area of alpine fir and white spruce forests defoliated by a two-year cycle budworm, *Choristoneura biennis* Free., in the interior of British Columbia, declined to only 2 200 ha, from 165 000 ha in 1983. However, infestations of the one-year cycle budworm. *C. orae* Free., in the Prince Rupert Region expanded ninefold to 2 700 ha. The general decline was attributed in part to the high incidence of *Beauveria bassiana* (Bals.) Vuill., in 1983, and cool, wet conditions which delayed development; the decline occurred in the Nass, Bell-Irving, Babine, Upper Skeena, and Kispiox river valleys in the Prince Rupert Region. Only about 10% of the buds were infested, down from 50%, and larvae per beating collection numbered less than 15 compared with up to 300 in 1983. Light-to-moderate feeding on current foliage was most extensive over 1 800 ha southeast of Prince George with localized 200 ha pockets in the Cariboo and Nelson regions. Collections from these areas continue to be studied by the Biosystematic Research Institute, Ottawa, to identify the insects and their life cycles.

Based on egg-mass surveys, defoliation in 1985 is not expected to occur where two-year cycle budworm predominates, but light defoliation could occur near Kitimat where one-year cycle populations exist.

Jack Pine Budworm

Choristoneura pinus pinus Free.

This close relative of the spruce budworm has long been regarded a serious pest of jack pine stands and plantations in northwestern Ontario, Manitoba, and Saskatchewan, and in the Lake states of the U.S.A. Only in recent years (1967–72) have destructive populations also occurred in central and eastern Ontario and Quebec. Tree mortality of up to 30–40% of the jack pine component in a stand may occur following 2 to 3 years of moderate-to-severe defoliation. Top killing is common also and may result in half or more of the stand being damaged.

Maritime Provinces

In New Brunswick, populations of this insect decreased drastically in 1984. Noticeable defoliation occurred at only two locations in Northumberland County. The insect was also collected at locations in Kent, Sunbury, and York counties. In 1983 defoliation of varying levels occurred over much of the area of naturally growing jack pine in the east-central part of the province.

In Nova Scotia, jack pine budworm was present in a Scots pine plantation in Cumberland County.

In Prince Edward Island the insect was not observed in 1984.

Ontario

Defoliation — The area of moderate-to-severe defoliation increased from 67 000 ha in 1983 to 1.15 million ha in 1984. This is the largest area of defoliation ever attributed to this insect in a single year in Ontario. The largest infestations (429 000 ha) occurred in the central part of the northeastern region with smaller pockets in adjacent areas of the northern region. Sizeable areas of defoliation (370 500 ha) were recorded in the north central region and approximately 153 000 ha were mapped in the northwestern region.

Damage — Little permanent damage is evident at this point although mortality of 1 and 5%, respectively, was recorded in Cascaden (Sudbury District) and Monestime (Espanola District) townships, in the northeastern region.

Forecast — Egg surveys indicate that most infestations will persist at the same or higher levels than those experienced in 1984. The area of moderate-to-severe defoliation is expected to increase substantially in the northeastern region and smaller increases in area are predicted for the northern, north central and northwestern regions.

Manitoba

Jack pine budworm infestations increased significantly in 1984. In Manitoba, the area within which moderate-to-severe defoliation was mapped totals

Figure 3. Areas of moderate-to-severe defoliation by the jack pine budworm in Canada.

760 000 ha, compared to 146 000 ha in 1983. Egg-mass counts indicate that medium-to-high populations will occur in the same areas in 1985.

Saskatchewan

In Saskatchewan, infestations occurred along the east side of the province, where moderate-to-severe defoliation by the jack pine budworm occurred over 26 800 ha. The forecast for 1985 is for medium-to-high populations within these areas and a possible expansion of the infestation.

Mountain Pine Beetle

Dendroctonus ponderosae Hopk.

Lodgepole pine is the principal host of the mountain pine beetle, but several other western pine species are susceptible. The beetles attack trees in mid- to late summer and infect them with a number of micro-organisms, including blue stain fungi that quickly kill sapwood and bark. Eggs laid by female beetles yield larvae that feed on the inner bark. Infested trees generally die from the combined action of blue stain fungi and the beetle larvae. The foliage of killed trees turns brown in the year following attack and tree mortality can then be detected by aerial surveys.

Because most beetle-killed trees are of suitable size for saw logs, the monetary loss in commercial forests can be significant if trees are not salvaged quickly. Other consequences are a hastening of forest succession, a change in age and diameter distribution of the pine component of forests, a reduction in aesthetic values, and an increase in fire hazard. Each of these effects can force disruptive and costly changes in forest management plans. Poor lumber markets have greatly reduced the forest industry's ability to salvage recently killed trees, particularly in British Columbia where large volumes of dead trees are involved.

The mountain pine beetle continued to be the most damaging forest insect in western Canada in 1984, resulting in extensive mortality of lodgepole pine and

western white pine, mainly in British Columbia, but also in Alberta and southwestern Saskatchewan (Fig. 4). Further details on the status of the mountain pine beetle infestations follow.

British Columbia

The most damaging pest in British Columbia in 1984 continued to be mountain pine beetle. Since 1972 an estimated 175 million mature pine have been killed in the province. Recent tree mortality extended over more than 482 000 ha in 7 500 active infestations from the international border to north of Hazelton. More than 12.1 million m^3, about 20% of the annual provincial harvest, of mature lodgepole pine and western white pine were killed by 1983 beetle attacks.

Based on surveys in representative stands, most infestations throughout the province are expected to expand and intensify. An average of 17% (range 1 to 65%) of the standing green lodgepole pine were attacked in 1984, down 5% from 1983, and are expected to be dead in 1985. The highest current attack was 24% in the Cariboo and Prince Rupert regions, down 8% from 1983. Tree mortality will continue at slightly lower levels in the Kamloops and Nelson regions and remain about the same in the Prince George and Vancouver regions.

Increases in area of pine mortality mainly in the Kamloops, Prince George and Vancouver regions and to a lesser extent in the Nelson and Prince Rupert regions, occurred as a result of general expansion of previously infested stands. Additionally, nearly 170 000 ha of 'grey', previously killed pine were mapped; 85% in the Cariboo Region and the balance in the Nelson Region.

Outbreaks in the Cariboo Region affected 381 000 ha and contained more than 33 million pine trees (7.6 million m^3). This accounts for 80% of the total and represents more than 13 times the average area logged of all species in the region annually.

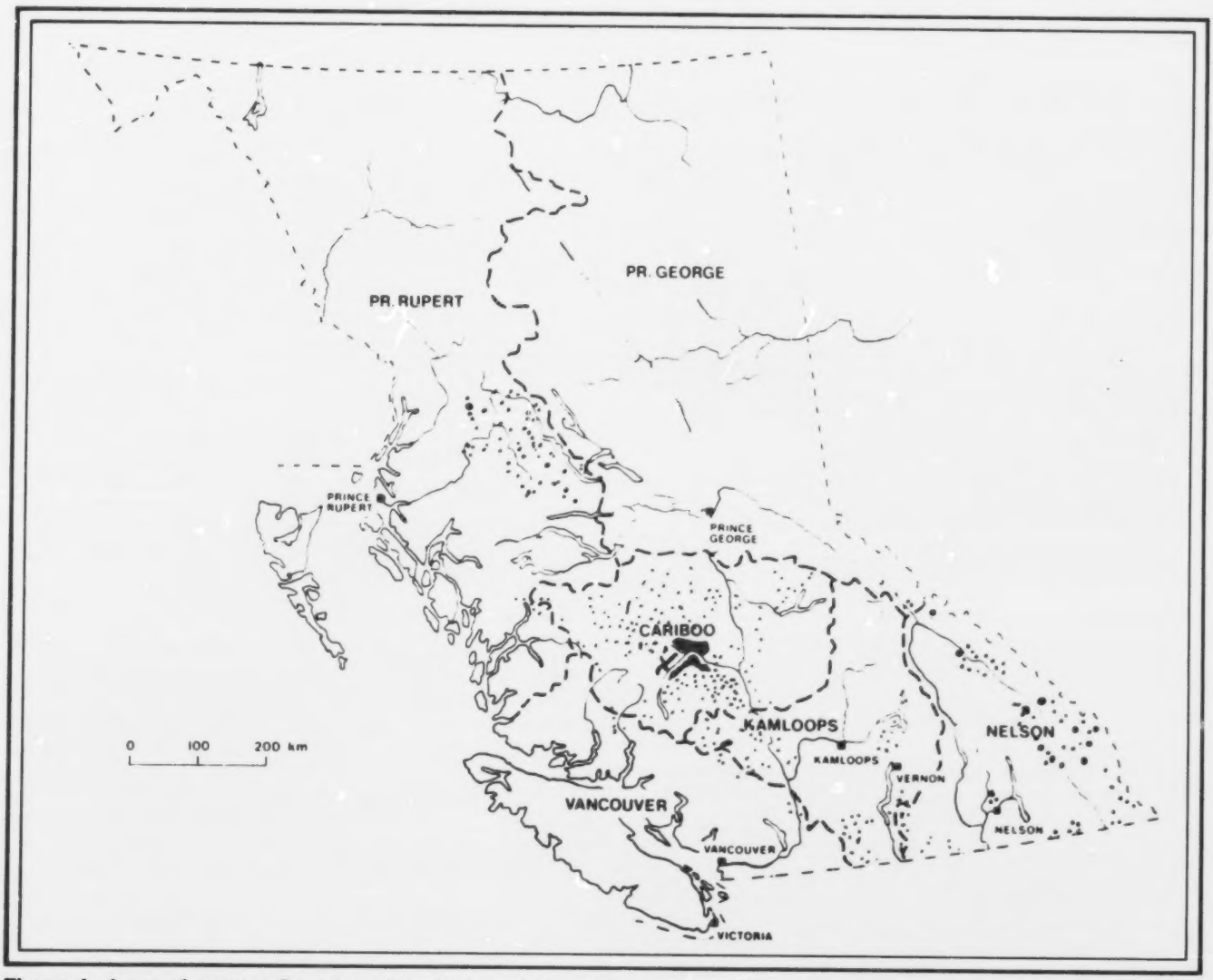


Figure 4. Areas of western Canada within which mortality by the mountain pine beetle occurred.

Area with recent tree mortality in the Kamloops Region expanded 24% to 58 000 ha. An estimated 600 infestations contained 5 million pine trees (2.7 million m^3) in chronically infested stands north from the international border, east and west of the Okanagan Valley and west of Lytton and Lillooet.

In the Nelson Region infestations covered about 21 000 ha which contained 1.8 million (660 000 m^3) lodgepole and some white pine in 1350 widespread infestations. In addition dead trees from earlier years of infestations extended over 25 000 ha. Host depletion from previous beetle attacks and harvesting has limited expansion of infestations, particularly in the eastern part of the Region. Infestations along the B.C.-Alberta border and within Kootenay, Yoho, and Banff National Parks increased slightly.

The area, number, and volume of lodgepole pine killed in the Prince Rupert Region increased slightly to 1.2 million trees (1.1 million m^3) on 14 500 ha, up from 13 300 ha in 1983. The increases occurred mainly in the Cranberry River drainage and between Hazelton and Terrace. Major outbreaks continued in Harold Price Creek, Fulton, Morrison and Babine lakes areas and in the Nass River drainage.

In the Prince George Region mortality of mature western white pine and some lodgepole pine expanded to 2 600 ha in the chronic infestations along the Canoe Arm south of Valemount and continued over 200 ha of lodgepole pine near Fort St. James.

The major expansion of infestations in the Vancouver Region to 5 000 ha was mostly in the Homathko River drainage, just west of the extensive outbreaks in the Cariboo Region. A beetle control program in Manning Provincial Park successfully reduced the number of beetle-infested trees from 5500 in 1981 to only three in 1984.

Poor lumber markets continued to hamper salvage and direct control operations. However a $5 million fund was established in September by the B.C. Ministry of Forests for road construction for extraction of threatened timber and treatments to reduce the spread of bark beetles.

Under the mountain pine beetle program of the Canada/USA Memorandum of Understanding, the current status of infestations, management actions, and research were reviewed; management guidelines have been updated; hazard rating systems are being evaluated, and samples collected for a study of large scale, profitable utilization of lodgepole pine.

Alberta

Aerial and ground surveys conducted in 1984 revealed a further general decline in areas affected by the mountain pine beetle, and in numbers of infested trees. Principal active infestations occurred in three locations in southern Alberta: along the east side of Waterton Lakes National Park, 25 km southwest of Pincher Creek, and throughout the southeast portion of the Porcupine Hills in the control area. Lodgepole pine is the main host species affected in the first two locations while limber pine is the main host in the latter location.

Other smaller infestations persisted in Kananaskis and Cypress Hills provincial parks. Sanitation cutting and burning, or bark peeling of infested trees were used as control measures at both these locations, as well as throughout most of the area from the Crowsnest Pass to the northern end of the Porcupine Hills. A total of about 10 000 infested lodgepole pine and 25 000 limber pine were treated during the 1983–84 winter period. No reports of infested pine were received from agricultural urban areas outside the forest reserves.

Cold temperatures (–40°C or colder) during December 1983, as well as heavy woodpecker predation caused a high incidence of mortality to the overwintering stages of the beetle. Pheromone-baited trees were used extensively in the control areas.

Saskatchewan

Considerable winter mortality of both adults and larvae were reported in the Cypress Hills, Saskatchewan, outbreak area during the winter of 1983–84; some damage and tree mortality is still being reported in this area. The control program continues in newly found infestation areas where less than 200 trees are likely to require control treatment.

Spruce Beetle

Dendroctonus rufipennis (Kby.)

In recent years, conditions favorable to the spruce beetle in several parts of Canada have resulted in significant spruce mortality. In the west, warm summers, mild winters, and increases in susceptible host material have triggered a rapid increase in populations of this pest, usually found at endemic levels in logging slash or in windthrown or damaged trees.

British Columbia

The affected area and volume of mature white and Engelmann spruce killed by 1982–83 beetle attacks, mostly in central and northwest British Columbia, declined 20% overall to 46 300 ha and 1.7 million m^3. This second year of decline was due mainly to harvesting, trap tree programs, host depletion and improved monitoring and cleanup programs. However, small isolated increases occurred in some areas.

Recent mortality of mature spruce in the Prince George Region mainly in the Bowron and McGregor river drainages declined by 25% to 515 000 m^3 over 26 000 ha. Still, this represents about 60% of the total area annually harvested in the Region.

In the Prince Rupert Region 400 infestations over 13 600 ha killed mature spruce (1.1 million m^3) from the Bell-Irving river drainage south to Ootsa Lake. Also, spruce beetle lightly attacked 20 mature, water-stressed

Sitka spruce on the Queen Charlotte Islands; this is the largest recorded number of standing trees attacked on the Islands.

The number of beetle-killed trees associated with improvements on the Haines Road between the Yukon and Alaska borders in northwest British Columbia was reduced from 300 in 1983 to 23, following a cooperative program of marking and treating of brood-infested trees.

Infestations in the Cariboo Region continued to decline with 2 200 ha in six widely scattered pockets along the eastern boundary of Bowron Lake Provincial Park. However, in the Nelson Region, scattered pockets of mortality of mature spruce expanded nearly twofold to 3 700 ha in 115 areas. Most infestations were associated with previously beetle-infested areas south of Glacier National Park, and near Golden, Top of the World Provincial Park, and Cranbrook. In the Kamloops Region also, areas of recently killed spruce doubled to 700 ha in nine areas, from the upper Adams River drainage to west of Lillooet.

Surveys in 19 stands indicate an overall reduction of new attacks to 5% (range 0 to 22%) of the trees in the stand, down from 13% in 1983. Extensive areas of recent spruce blowdown in northcentral B.C. absorbed much of the current year's attack in the Prince Rupert Region. This could contribute to increased populations and tree mortality if not salvaged before 1986. Broods in 1984 that attacked standing trees in the cruised areas were predominantly two-year cycle and less vigorous than in previous years. Weak lumber markets and relaxed utilization standards could also contribute to increased beetle populations and tree mortality. Portions of the recently announced special provincial bark beetle fund will be allocated for road access to accelerate timber extraction, and for additional ground surveys to locate sites for trap tree programs.

Alberta

Most mature and overmature (older than 120 yr) stands of white spruce surveyed in 1984 showed only endemic population levels of the spruce beetle, except for several widely scattered locations throughout northern Alberta. This suggests a general decline in population over the past two years. Cold winter temperatures, heavy woodpecker predation, and salvage logging in severely infected stands have contributed substantially to this apparent decline. However, several mature and overmature stands in the Slave Lake, Peace River, Athabasca, and Footner Lake Forest districts still have a high potential for future spruce beetle outbreaks. These stands are being monitored on an annual basis for blowdown and areas of population increase.

Nova Scotia

Cape Breton Island has been the major outbreak area during the past few years. By the end of 1983 no substantial areas remained on Cape Breton Island that were without severe white spruce mortality. In 1984 new patches of mortality occurred only in the western and northern parts of the Island; generally less than 10% of the remaining trees were affected. However, in many areas more than half of the white spruce trees, especially the more mature ones, are now dead as a result of the outbreak. On the mainland, white spruce mortality was much less than in 1983 and was observed only in a few isolated pockets.

Prince Edward Island

Spruce beetle activity occurred in Queens and Kings counties in previously affected areas, but few newly attacked trees were observed. About a third of the province's merchantable white spruce has succumbed to this insect in past years. As a result, spruce beetle remains a serious threat to forestry. It is also a problem in agriculture, because many of the trees killed are in hedgerows and windbreaks.

New Brunswick

The small infestations reported in previous years remained active. Consequently more mature white spruce trees were attacked. On the Cross Fundy Trail, Fundy National Park, 32% of the trees are dead or dying from beetle attack. Until 1984 only areas in the extreme southern part of the province were known to be infested by the spruce beetle. In 1984, spruce beetle-infested trees were found in several areas in Restigouche and Northumberland counties in northern New Brunswick. Although these areas are small and very few trees are currently affected at each location, this constitutes a significant change in the distribution of the insect. The affected areas are widely separated, and in these areas the condition of trees could be conducive to a population buildup of the spruce beetle.

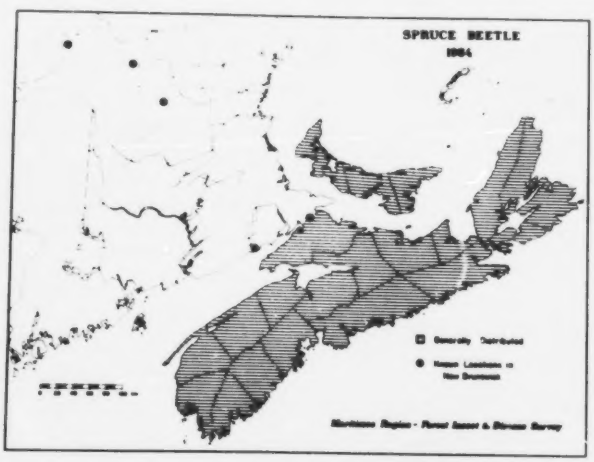


Figure 5. General distribution and known locations of spruce beetle in the Maritime Provinces.

Newfoundland

Population levels continued to rise with new areas of infestations being reported near Serpentine Lake and the Humber Valley in western Newfoundland. Several areas of white spruce stands that have been attacked since 1982 have scattered tree mortality.

Eastern Larch Beetle

Dendroctonus simplex LeC.

This insect normally attacks only weakened, damaged, or recently felled host material. However, when populations are very high, the insect can also attack living, apparently healthy, mature or overmature trees. Even younger, small diameter trees can become infested.

Maritime Provinces

In the Maritimes Region, a population buildup was first noticed in Nova Scotia in 1976. This increase in beetle populations followed several years of severe defoliation of larch by the larch sawfly, *Pristiphora erichsonii* (Htg.). Since then, the beetle has become widespread in all three provinces and has caused serious tree mortality. By the end of 1981, when the last detailed survey for this insect was conducted, an estimated 24% of merchantable-size larch was dead in New Brunswick, 64% in Nova Scotia, and 13% in Prince Edward Island.

In 1984, there was no dramatic change in the status of the insect in the region. Dying trees were observed at several locations, notably in western New Brunswick. At a research plot in central New Brunswick, a further 3.5% of the trees became infested in 1984 (compared to 2.9% in 1983) and a further 1.9% of the trees died (compared to 2.9% the previous year).

Newfoundland

Population levels of this beetle showed a slight decrease on the Avalon Peninsula but clumps of dying larch trees were common in central Newfoundland. In Labrador, high population levels of this beetle caused some tree mortality in stands previously defoliated by the larch sawfly along the Churchill River Road. The beetle was also present in scattered larch stands from Gull Lake to Cartwright.

Scleroderris Canker

Gremmeniella abietina (Lagerb.) Morelet

Scleroderris canker has been detected in all provinces except Prince Edward Island, Manitoba, and Saskatchewan. This disease of conifers is caused by the fungus, *Gremmeniella abietina*. At least two races of this fungus have been determined serologically.

North American Race

The North American race of *G. abietina* is widely distributed in Canada and has been a serious problem in nurseries and young plantations for many years. Extensive studies of the disease have provided a number of control recommendations. In eastern Canada, the disease is most damaging to pines, especially red, jack, and Scots pines, and often kills them during their first decade of growth. Once the trees attain a height of about 2 m, they are relatively safe from lethal attack. In western Canada, where lodgepole, ponderosa, and whitebark pines are the principal hosts, the disease has occurred at only a few scattered locations in Alberta and British Columbia. No significant damage has been attributed to this disease in either province.

Maritime Provinces

The North American race was first detected in New Brunswick in 1971 and is now widespread throughout the province, especially in pine plantations in the northern half of the province. Little new infection has been observed since 1980 and then only in areas already known to harbor the disease.

In 1984, the disease was observed in several areas in the province. However, the anticipated increase in new infections, predicted on the basis of weather conditions during last year's infection period, did not materialize. There was only a 3% increase in the number of infected trees at a study plot in Kings County, the most active spread area in the province in 1984.

In Nova Scotia, the disease was first found in 1972; a few pine plantations suffered limited lower branch mortality during the mid-1970s. No damage has been detected in the province since 1978.

The disease has not yet been found in Prince Edward Island.

Ontario

In Ontario, the North American race of scleroderris canker disease damaged pine plantations in a number of areas in northern and southern Ontario. The most severe occurred in Haughton and Kirkwood townships, Blind River District where 79% and 34% of the red pine trees were infected, with mortality of 16.8% and 2.2% respectively. In McMurrich Township, Parry Sound District, three red pine plantations totalling 23 ha in area had 24.6% of the trees severely damaged with an average mortality of 1.3%. A 0.5-ha red pine plantation in Macauley Township, Bracebridge District, which had 61% of the trees infected and current mortality of 13%, was cut and burned by OMNR staff. Nearby plantations were sanitized by removing and burning the lower branches in an effort to curtail spread of the disease. An infection rate of 26% was recorded on roadside jack pine trees in Lastheels Township, Wawa District.

European Race

In 1975, a disease syndrome different and more serious than that normally associated with scleroderris canker in North America was reported in New York State. The disease was killing large pine trees and was serologically identified as the European race of *G. abietina*. It has since been detected at scattered locations in Quebec, New Brunswick, and Newfoundland. Except in Newfoundland, the symptoms and damage caused by the European race have been indistinguishable from those of the North American race.

Maritime Provinces

In New Brunswick, the European race was first detected in 1978. Since then, the European race and other races serologically identified as intermediate between the North American and European races have been found at other locations. Plantations affected by these races have either been removed or are under close surveillance for changes in symptom expression.

This race has not yet occurred in Nova Scotia or in Prince Edward Island.

Quebec

From pure cultures of *G. abietina* isolated during a 1983 study of scleroderris canker in the Outaouais region, eight were selected which had been collected in plantations showing symptoms similar to those observed in New York State. These suspect isolates were tested by the Great Lakes Forest Research Centre in Sault Ste-Marie, Ontario, and six were serologically identified as the European race. Consequently, a major survey was planned for the summer of 1984 to clarify the status of the two *G. abietina* races in the region.

Using plantation lists supplied by the Outaouais administrative region, most of the red pine and Scots pine plantations aged from 6 to 30 years in the region were mapped. The area sampled was located on the north shore of the Ottawa River and included the valleys of the Gatineau, Lièvre and Rouge rivers. FIDS technicians rapidly assessed the plantations for symptoms of the disease, and sent samples from infected trees to the diagnostic laboratory at the Laurentian Forest Research Centre for analysis. From samples which tested positively for scleroderris canker, pure cultures of the fungus were obtained for subsequent serological identification.

During the summer, slightly over 1 000 plantations were surveyed (three-quarters of which were red pine, and one-quarter, Scots pine), including fifty or so red pine plantations in which experimental plots had been established last year. Laboratory tests revealed *G. abietina* infection in 156 (17%) of the red pine plantations surveyed and 6 (2%) of the Scots pine plantations. These estimates are conservative because the disease cannot be detected at trace-to-low levels. In general, the infected plantations can be grouped into three areas: one to the east of Fort-Coulonge, another to the north of Mont-Laurier, and the third to the northeast of L'Annonciation.

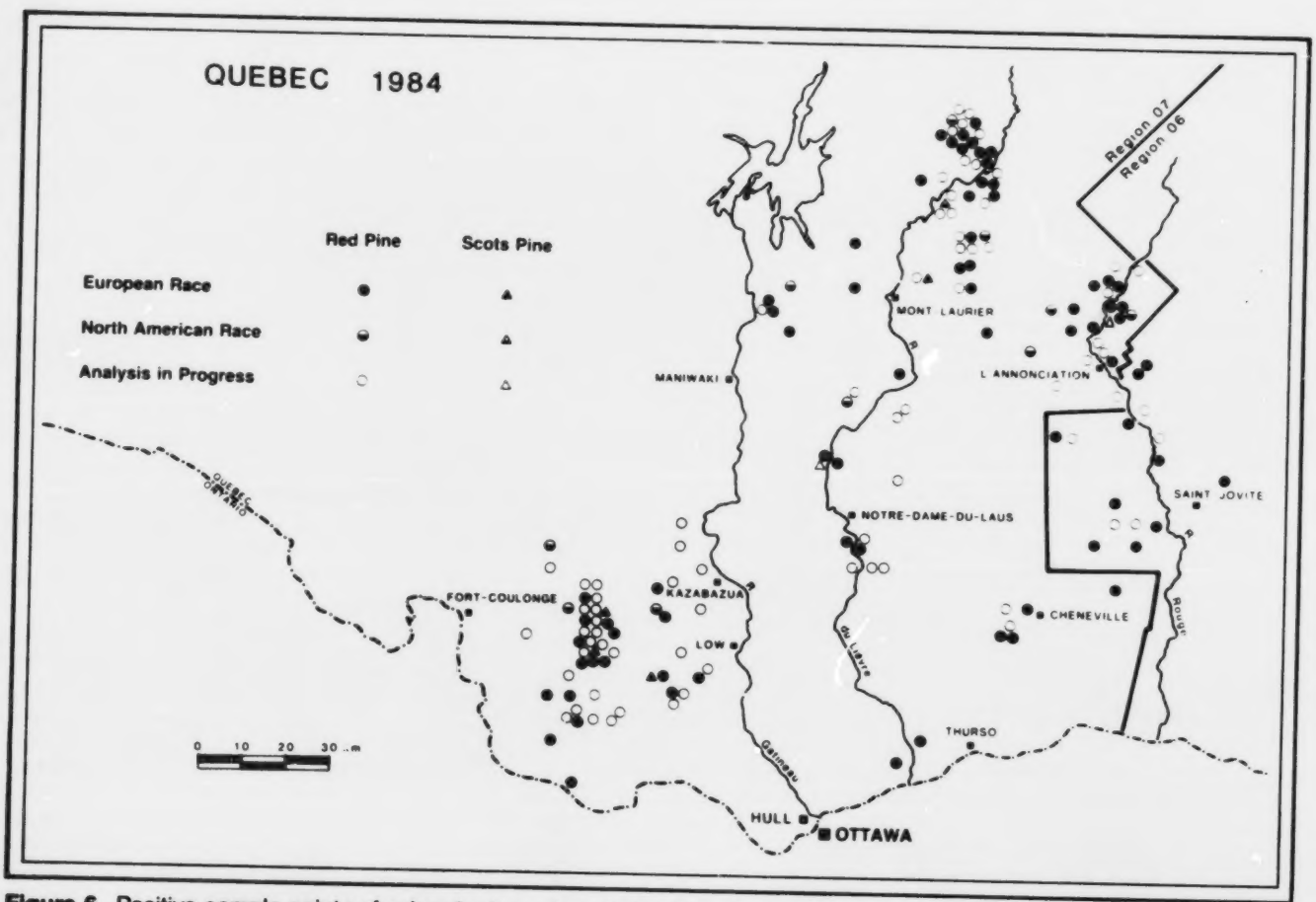


Figure 6. Positive sample points of scleroderris canker of pine found in southwestern Quebec.

These infected plantations include an estimated two million red pines, or about one quarter of the total red pines inventoried. The number of infected Scots pines is about 60 000, or 4% of those inventoried. Given that the primary aim was to survey as many plantations as possible, a standard assessment of the amount of damage in each plantation was not conducted. However, a visual assessment indicated that damage was moderate-to-severe in almost half the infected plantations, and trace-to-low in the others. Natural stands of jack pine located in, or close to, highly infected plantations showed no symptoms of the disease.

In view of the large number of samples and the difficulties involved in serologically determining the different races of the fungus, only preliminary results have been obtained so far. Including the six plantations which tested positively for the European race last year, there is a total of 45 plantations (of which two are Scots pine) infected with this race. These are distributed throughout the inventoried area. The North American race was found in only six plantations. A research team at the LFRC is designing a new test that will allow a more rapid identification of the two races.

Tests are currently being conducted on pruning, trimming, and thinning in various plantations in the Outaouais region. However, results will not be apparent until the summer of 1985. As early as 1982 the systematic pruning of red pine plantations was recommended. This has since been done by various participants in the Maniwaki region, the area north of Mont-Laurier and the valley of the Rouge River. In the past year sanitation cuts were also undertaken in the six plantations in which the European race of the fungus had been found the previous year.

Ontario

In Ontario, the European race of this disease has not yet been found despite an intensive program of aerial and ground surveys to detect its presence.

Newfoundland

In Newfoundland, this canker continued to spread in the St. John's and the Salmonier Line areas. Ornamental pine trees in some locations in St. John's had about 70% of the foliage affected. In addition, several new infection sites were located in Bowring Park, the arterial road, and one along the Salmonier Line. The infection on the Salmonier Line is the second record of the disease outside the quarantine zone established by the Department of Forest Resources and Lands. The pruning of infected trees continued in St. John's and the infected tree on the Salmonier Line was removed in an attempt to eradicate the disease in that area.

European Larch Canker

Lachnellula willkommii (Hartig) Dennis

Maritime Provinces

European larch canker has been a serious disease in many parts of Europe. The fungus is generally considered to be a primary pathogen and its presence in Europe has resulted in the exclusion of larch from plantation programs. In North America, the fungus was found in Massachusetts in the 1920s in European larch plantations. Periodic concentrated eradication attempts appeared to have been successful because the disease was not found in 1965 during a survey of the area.

In 1980, European larch canker was discovered in New Brunswick and surveys since then have established the distribution of the disease as widespread in most of southern New Brunswick and mainland Nova Scotia.

In 1984, an infected stand was found outside the known range of the disease at Leverville, Charlotte County. It is questionable whether this find is a genuine extension of the disease or simply a refinement of the border line because the stand is situated just outside the known range and 53% of the trees examined were cankered. Surveys elsewhere in New Brunswick, and at the 48 survey locations in Prince Edward Island, failed to detect infected trees.

A survey to establish age and spread pattern indicates that the fungus could have been present in the Maritimes for about two decades before its discovery and may have spread from specific points to other areas. The study also showed a rapid decrease in incidence of infected trees with increasing distance from the southern shores of the Bay of Fundy, possibly indicating a climatic dependence.

The disease is capable of intensifying rapidly in young stands. Incidence of infected trees in a research plot increased as follows, based on fall assessments: 7% in 1982, 19% in 1983, 46% in 1984. To test differences in susceptibility to infection, a few one-year-old, greenhouse-grown seedlings from 30 provenances of *Larix decidua, L. leptolepis, L. eurolepis, L. laricina* and *L. sibirica* were planted in a heavily infected area in the early summer of 1983. Cankers, bearing fruiting bodies of *Lachnellula willkommii*, were found on three seedlings in the fall of 1984. All three infected seedlings were of *Larix decidua*, two on provenances from Denmark and one from Czechoslovakia.

Because the fungus infects mostly young trees, future wood supplies may be affected. Tree mortality reduces stocking, branch mortality reduces growth, and cankers reduce wood quality. The extent to which the disease will cause damage in the Maritimes is not yet known but the potential for damage is there. The role of the disease will have to be considered in view of increased emphasis on forest renewal and larch tree improvement programs.

Gypsy Moth

Lymantria dispar (L.)

The gypsy moth was introduced into the United States around 1870. The first detection in Canada was in 1924 in southern Quebec and then in 1936 in southwestern New Brunswick. Both these infestations were successfully treated by the Plant Quarantine Division of Agriculture Canada. Since 1955, isolated infestations have been recorded in southern Quebec and up to 800 ha were treated annually from 1959 to 1965 to keep the infestations under control. However, during 1966–67 the infested area increased rapidly and became widespread. In 1969–70, the insect moved into eastern Ontario and in the following years, small pockets of infestation were observed at various locations in the Eastern Region, particularly in the Cornwall and Kingston areas. From 1975 to 1980, the northward movement of the insect was slowed by the treatment of critical areas. From 1980 to 1983, however, the general area of infestation expanded considerably. The gypsy moth reappeared in the Maritimes in 1981 and by 1983 was considered to be at least temporarily established in both New Brunswick and Nova Scotia.

The gypsy moth was found in Vancouver, B.C., in 1978 and a control program was carried out by the Plant Health Division of Agriculture Canada and the city of Vancouver in 1979 in an attempt to eradicate it. Surveys in subsequent years have failed to find egg masses or larvae of the insect in the previously infested area or in other areas of greater Vancouver where male moths were trapped in 1982.

Newfoundland

Special surveys were conducted in cooperation with Agriculture Canada again in 1984 to monitor any introduction of these pests. Pheromone traps were located in camping parks and near major towns. No gypsy moth were found.

Maritime Provinces

In New Brunswick the insect was again present in 7 of the 10 areas where it occurred in 1983. In addition, an egg mass was found at Burnt Hill, Charlotte County, a new location. This area, however, is only about 4 km from Mohannes where gypsy moth was first found in the province in 1981. Larvae, pupae or fresh egg masses were found in Fredericton (York County) and in parts of Charlotte County. Numerous egg masses were located with little effort at both St. Andrews and Fredericton. These two areas are considered to harbour the highest local gypsy moth populations in the province.

In Nova Scotia, gypsy moth was found for the first time in 1984 at Dartmouth, Halifax County; Middleton, Annapolis County; and Weymouth, Digby County. It was present again at locations in Yarmouth County, Annapolis County, Kings County, Halifax County and Shelburne County. There were 59 new egg masses located in Shelburne, Shelburne County, 11 of these on

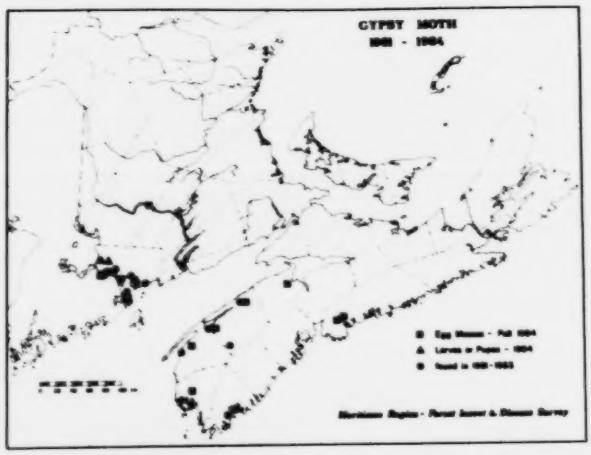


Figure 7. Known locations of gypsy moth in the Maritime Provinces.

a single tree. In excess of 150 egg masses were found in New Minas, Kings County. Gypsy moth must be strongly entrenched in at least these two localities in the province.

In Prince Edward Island gypsy moth has not yet been known to occur. In the Maritimes Region the gypsy moth monitoring committee again coordinated all surveys in 1984. This committee, formed in response to the discovery of gypsy moth in 1981, has made an effort to utilize available manpower more efficiently to combat this latest threat to the forests of the region. Organizations involved in surveys include the Forest Insect and Disease Survey of the Canadian Forestry Service, Parks Canada of the federal Department of Environment, the Plant Health and Inspection Branch of Agriculture Canada, New Brunswick Department of Natural Resources, New Brunswick Department of Agriculture, Nova Scotia Department of Lands and Forests, Nova Scotia Departent of Agriculture, and Prince Edward Island Department of Energy and Forestry. The New Brunswick Department of Environment has been involved in discussions on control. In addition, hundreds of volunteers, campground operators, small woodlot owners, biology teachers, students and other interested private citizens have assisted in the extension pheromone trapping program.

The adult male trapping program aims at defining areas where egg-mass searches should be concentrated. As a result of studies since 1980, the trap placement timing has been changed to eliminate, or at least minimize, interference from large numbers of male moths (females are flightless) which have been brought into the region by weather fronts from infested areas in the United States.

In 1984, information was obtained from 985 traps in New Brunswick, 885 in Nova Scotia and 202 in Prince Edward Island. Cooperators better understood the value of "negative" results and, as a result, greatly aided the planning of the fall egg-mass surveys. Although the number of positive traps or moths captured should not be taken in isolation, the following is offered to demon-

strate the value of trapping. Although 28% of the traps in Nova Scotia were positive, i.e., captured at least a single gypsy moth male, 48% of the traps were positive in western Nova Scotia where the gypsy moth is known to occur. However, only 6% of the traps were positive in the eastern part of the province where gypsy moth is not established. Further, the average number of moths in positive traps was almost fourfold in the west compared to eastern Nova Scotia. The differences were even more pronounced between infested Charlotte County and the noninfested northern counties of New Brunswick. There were no moths captured in any of the 202 traps in Prince Edward Island in 1984.

Control operations against the gypsy moth in 1984 were localized and sporadic. As a result, no reliable information is available. Several communities (Fredericton, St. Andrews, Digby) became involved in public awareness programs emphasizing citizen participation in combatting this newly arrived pest.

Quebec

No major damage by the gypsy moth was reported in 1984. Larval populations remained at trace-to-low levels within the known distribution zone. Over 100 egg masses were discovered in Quebec City and subsequently destroyed. No egg masses were detected outside the known distribution zone. Populations are expected to increase slightly in 1985.

Ontario

In Ontario, substantial increases occurred in the area infested by this insect in the Eastern Region for the fourth consecutive year. A total area of 80 624 ha sustained moderate-to-severe defoliation compared with 40 954 ha in 1983. Most of this area was located in the central part of the Tweed District and the eastern part of the Napanee District. The remainder was located in adjacent areas in the western sections of the Carleton Place and Brockville districts. Elsewhere in the province small numbers of larvae and egg masses were located at three locations in the Pembroke District of the Algonquin Region and in the City of Oakville in the Cambridge District of the Central Region. Surveys in early August disclosed numerous egg-laying female moths within a 32-ha area near Port Colbourne on the north shore of Lake Erie in the Niagara District of the Central Region.

In 1984 the FIDS Unit and the Parks Branch of the Ontario Ministry of Natural Resources repeated a larval and pheromone trapping program in provincial parks in southern Ontario. The larval trapping produced positive

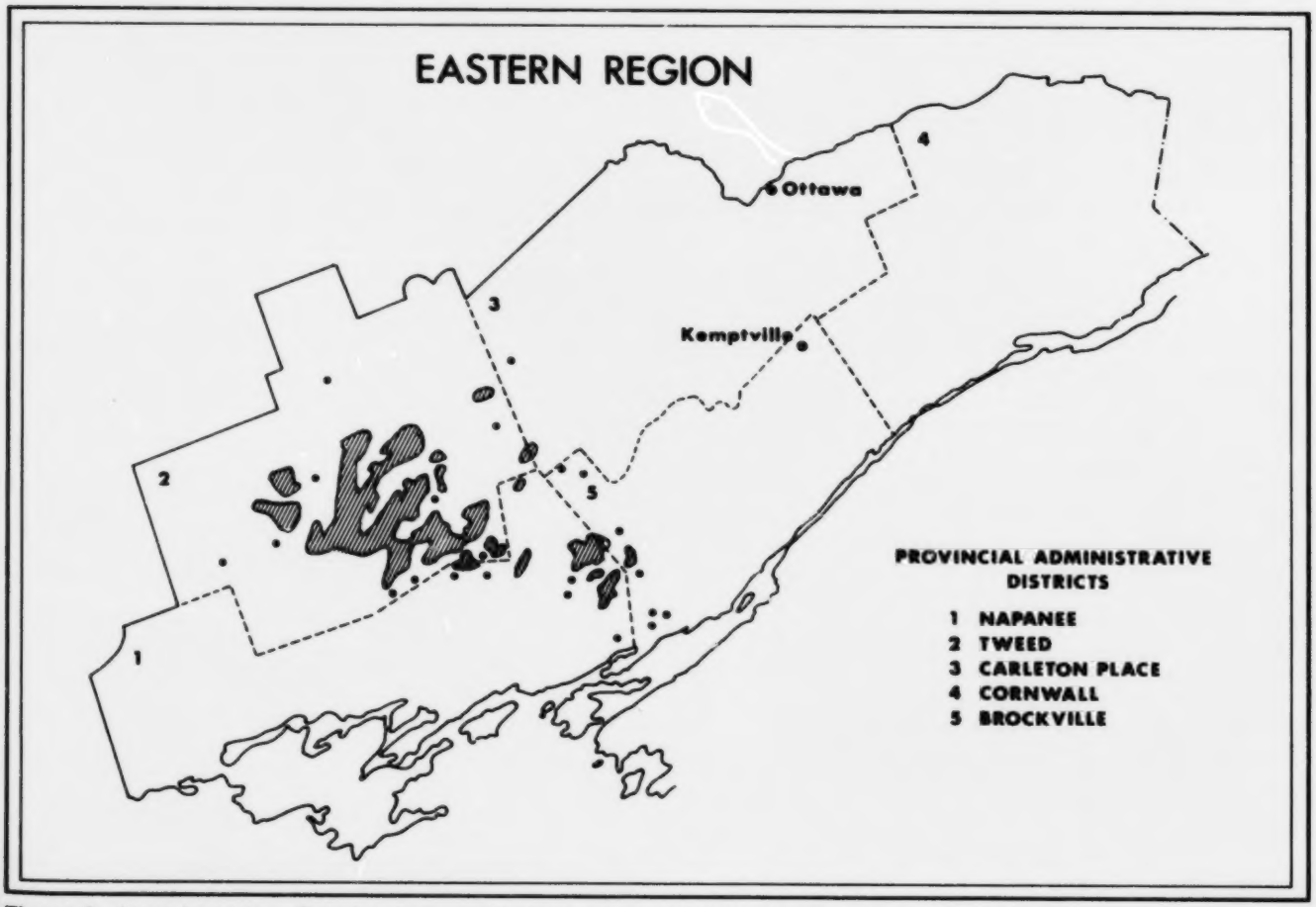


Figure 8. Areas in eastern Ontario where moderate-to-severe defoliation by the gypsy moth occurred.

results in nine parks in the Eastern Region compared with seven in the same region in 1983. The pheromone trapping program yielded positive catches of male moths at 49 of 62 parks compared with 27 of 71 parks in 1983. Pheromone trapping at 55 parks and campgrounds in northern Ontario produced positive catches at four locations, one each in the Terrace Bay, Hearst, Sudbury, and Espanola districts.

Alberta

The first collection of this insect in Alberta occurred when one adult male moth was collected in a pheromone-baited trap in Sherwood Park near Edmonton, Alberta.

British Columbia

First recorded in British Columbia in the lower mainland in 1976, adults and egg masses were again found in 1984. Larvae along with egg masses were recorded in Courtenay in June; in September, 25 male moths were caught in 12 pheromone traps. Agriculture Canada also trapped two moths in east Vancouver, one near Cultus Lake and four at Chilliwack where 11 egg masses have also been located. Moths were not trapped at Langley where treatments with *Bacillus thuringiensis* occurred in 1984; nor were any trapped in 117 forested recreation areas monitored by the Forest Insect and Disease Survey. A single moth trapped at Adams River, east of Kamloops, was the first evidence of gypsy moth in interior British Columbia. Defoliation has not occurred and populations have not yet become established in this area.

Although ornamental and urban trees could be severely defoliated if populations become established, the major forestry concern would likely be quarantine restrictions such as those recently implemented in active gypsy moth areas in Oregon. Egg-mass removal, some localized treatments, and further trapping programs are planned in 1985.

Dutch Elm Disease

Ceratocystis ulmi (Buis.) C. Moreau

Dutch elm disease is caused by the fungus, *Ceratocystis ulmi*, that is transmitted chiefly by elm bark beetles. It was accidentally introduced into Canada and since its first discovery in Quebec has spread over an area stretching from southern Manitoba to the Atlantic Ocean, excluding Newfoundland. All native species of elm are susceptible, including white, red, and rock elms. The disease has caused extensive mortality in eastern North America and will probably become a serious problem in all areas where elms are grown. Few, if any, pests have had as great an impact on shade tree populations in urban areas as has Dutch elm disease. Elms are also valuable timber producing species in some areas and there the disease has had an important effect on the local economy.

In 1982 Forest Insect and Disease Conditions in Canada reviewed the history and status of Dutch elm disease. An update follows:

Maritime Provinces

In New Brunswick, there was a resurgence of infection on small trees in the Fredericton area and along the Keswick River as far as Zealand, York County. Some of the infected trees were only 1.5 m in height.

There was an overall reduction in the annual loss in 1984 in Fredericton, where the progress of Dutch elm disease and the effect of the control program have been monitored since 1961 when the disease was first found in the city.

The 35 trees killed by the disease in 1984 represented 1.1% of the current elm tree population within the Dutch Elm Disease Management Area. This is the fourth consecutive decrease in the annual loss rate since 1980 when it reached a peak of 7.8%, followed by 5.3% in 1981, 3.0% in 1982, and 2.4% in 1983. Losses to date amount to 27.0% of the original urban elm stand.

In Nova Scotia, there was little spread of the disease in 1984 as most "new" locations were within or on the peripheries of the known distribution (Fig. 9). The only exception was Berwick, Kings County where the discovery of the disease has closed the gap between the two infested areas in the Annapolis Valley. However, the disease intensified greatly in many areas within the known range, indicated by newly infected, dying trees. In Antigonish County, where the disease was first found in 1981, in excess of 100 dead and dying trees were counted just north of the town of Antigonish in 1984. Near Newport, Hants County, 11% of the trees became infected between 1980 and 1982, the infection rate increased significantly to 55% in 1983 and reached 69% in 1984. This pattern agrees with that found in other parts of the Maritimes and indicates that most elm trees will become infected within a few years in this area. The disease also intensified in other outbreak areas where no sanitation is practised.

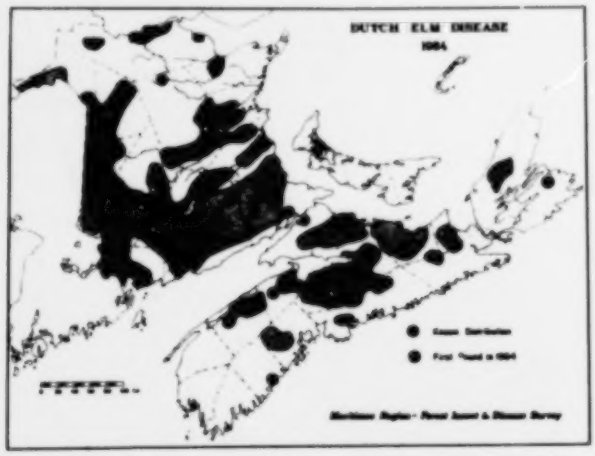


Figure 9. General distribution and new locations of Dutch elm disease in the Maritime Provinces.

In Prince Edward Island no infected elm trees were found in 1984. The disease was first discovered in 1979 in Prince County. This discovery was followed by an immediate, vigorous sanitation cut by the provincial government. No infected trees were found in 1980 and 1981. One infected tree was identified, and removed, in 1982; and there was none found in 1983.

Quebec

Dutch elm disease has spread to Sagard (Chicoutimi), south of the Saguenay River, causing some mortality.

Ontario

There was little change in the status of this disease in Ontario in 1984. All major concentrations of elms in the province are now infected; only a few scattered outlying pockets of elm are still free of disease. Surveys within these areas and on the fringes of the currently infected areas revealed no change in distribution. Dutch elm disease continued to cause heavy damage to elm reproduction and to kill off surviving mature trees in older infected areas.

Manitoba

Dutch elm disease continued to show a steady increase in rural elm stands of southern Manitoba in 1984. The disease also increased notably in farm shelterbelt plantings of American and Siberian elms throughout the outbreak areas in eastern and central Manitoba. However, the number of diseased elms remained relatively low in urban centers with control programs.

Saskatchewan

In Saskatchewan, intensive surveys failed to detect any diseased trees in 1984. Native elm bark beetles were recovered in several locations throughout the province. However, no European elm bark beetle has been trapped since 1983, when a single beetle was trapped.

Douglas-fir Tussock Moth

Orgyia pseudotsugata (McD.)

Populations of this serious defoliator collapsed after three successive years of defoliation of mature and immature Douglas-fir forests in southcentral British Columbia. Only 160 ha were defoliated near Cherry Creek west of Kamloops, down from 23 475 ha throughout four regions in 1983. The high incidence of natural control factors including a nuclear polyhedrosis virus and dipterous parasites were significant in the decline. Egg-mass surveys in and around the 1984 infested stands and pheromone-trapping results indicate collapse of the populations.

Tree mortality in previously defoliated stands was mapped in 47 areas totalling 5 500 ha near Kamloops and Cache Creek. Mortality averaged 43% in immature stands severely defoliated for two or three years. Mortality was patchy and varied, and exceeded 90% on some sites, although in one study area, 90% of the mature Douglas-fir recovered successfully. Also, in 6 of 16 stands examined, Douglas-fir beetle killed 29% (range 5 to 60%) of the defoliation-weakened trees.

Forest Tent Caterpillar

Malacosoma disstria Hbn.

The forest tent caterpillar again caused moderate to severe defoliation on trembling aspen, as well as a variety of other hosts in many areas of Canada. Although outbreaks of this insect can be spectacular in appearance, there have been few reports of appreciable tree mortality. The main effect of outbreaks has been the reduction in annual growth of severely defoliated trees. The significance of this reduction is difficult to assess. The affected tree species comprise a major portion of the hardwood volume in Canada, yet a relatively small portion of it is harvested each year. As the utilization and management of aspen intensify, the impact of aspen defoliators will become more significant.

Newfoundland

Special surveys were conducted in cooperation with Agriculture Canada again in 1984 to monitor any introduction of these pests. Pheromone traps were located in camping grounds and near major towns. A total of 62 male forest tent caterpillar moths were trapped across the Island.

Maritime Provinces

In New Brunswick, severe defoliation, especially of poplars, occurred over 90 500 ha in 1984. Defoliation was moderate over 3 900 ha. The 94 400 ha of severe and moderate defoliation represents less than 8% of the 1 199 000 ha affected in 1983. All defoliation occurred in the eastern part of the province, in six distinct areas and in several smaller patches in Northumberland, Kent, and Westmorland counties (Fig. 10).

The outbreak has been shifting to the southeast since it first started in the Woodstock, Carleton County area in 1979. The drastic reduction was far greater than anticipated for 1984, although a lessening of the outbreak, following a population decline had been expected. A weakened forest tent caterpillar population combined with weather conditions unfavorable to its survival probably hastened the almost total collapse of the New Brunswick outbreak earlier than anticipated. Several factors have played an influential role: there has been a buildup of diseases, parasites and predators such as the sarcophaga flesh fly; there was mass starvation of larvae at the height of the outbreak at many locations which resulted in fewer egg masses being laid. All of these factors weakened the forest tent caterpillar population. In addition, there were two consecutive years when the early summer was cool and precipitation was much above normal.

Figure 10. Areas of moderate-to-severe defoliation by the forest tent caterpillar.

In Nova Scotia, forest tent caterpillar caused 44 100 ha of severe, and 2 300 ha of moderate defoliation in 1984, an 11 400 ha increase from 1983 in the area of the outbreak. Most of the defoliation occurred in Annapolis, Kings, and Hants counties but the insect also affected trees in numerous patches in northern Cumberland County. In the Annapolis Valley, poplars, birch and even alder were completely stripped of foliage in some areas. Although the insect was present in many other parts of the province, the highest populations were found in western Nova Scotia.

In Prince Edward Island, the long standing forest tent caterpillar outbreak continued in 1984. Defoliation of trembling aspen was severe over 22 400 ha and moderate or severe over 15 000 ha in western Prince County. The area affected was essentially the same as in 1983 (Fig. 10). However, the level of defoliation increased in the northwestern parts and decreased in the southeast where defoliation affected fewer stands and to a lesser degree than in 1983.

Quebec

Cases of the forest tent caterpillar were reported only in Témiscamingue (western Quebec), where defoliation was moderate-to-severe in several locations between lakes Témiscamingue and Quinze. The infected area totalled approximately 200 ha, and the host species were trembling aspen, white birch, and sugar maple.

Ontario

Populations of this defoliator have declined steadily for the past three years but began to increase again in 1984. The total area of moderate-to-severe defoliation recorded in the province was 124 750 ha compared with 30 600 ha in 1983.

The long standing infestation south of the city of Thunder Bay increased by 12 000 ha to 38 500 ha in size. Similarly the infestation northeast of Matheson in the Kirkland Lake District increased by 2 300 ha to 6 400 ha this year. Egg-band counts at both locations

indicate that populations will probably persist at the same or higher levels in 1985. A slight spread to the north into O'Connor and Neebing townships is predicted for the Thunder Bay infestation.

New infestations were discovered this year north and west of Lake Temiskaming in the adjoining Kirkland Lake and Temagami districts (78 650 ha) and south of Elliot Lake in the adjoining Blind River and Espanola districts (1 200 ha). Egg counts indicate that the Lake Temiskaming infestation will remain high next year with some spread to the south into the Latchford-Temagami area. The Elliot Lake infestation is expected to increase in intensity in 1985 but not enough egg counts were completed to forecast the size of the infestation next year.

Manitoba

In Manitoba, moderate-to-severe defoliation by the forest tent caterpillar occurred over the same area (600 000 ha) as last year, but population intensity declined. Populations are expected to decline in 1985.

Saskatchewan

In Saskatchewan, moderate-to-severe defoliation occurred over a few hectares in isolated areas in the eastern part of the province, a significant decrease from 1983.

Alberta

In Alberta, approximately 1 335 000 ha of aspen were moderately-to-severely defoliated; this is a 67% reduction compared to 1983. Egg-band surveys conducted in 53 localities indicate a further decline in populations. Only 23% of sampled localities are forecast to have moderate-to-severe defoliation in 1985.

British Columbia

About 30 700 ha of trembling aspen stands in northern British Columbia were defoliated by forest tent caterpillar. For the second year, defoliation occurred in the Salmon River Valley and along the Peace River with moderate or severe defoliation over 29 700 ha. In the Prince Rupert Region, stands totalling 1 000 ha from Moricetown to Kitwanga were again defoliated. Scattered aspen and cottonwood groves and other trees and shrubs were lightly defoliated around Trail, but populations in the Cariboo Region collapsed.

Hemlock Looper

Lambdina fiscellaria fiscellaria (Gn.)

Maritime Provinces

Populations of this insect have been low in New Brunswick, Nova Scotia, and Prince Edward Island in the past few years and they remained so in 1984.

Newfoundland

Population levels of the looper have been increasing gradually during the past few years in many locations on the Island. In 1983 two infestations were reported; one on the Avalon Peninsula on about 9 000 ha and the other in the Bay d'Espoir area on about 200 ha.

Seasonal development of the looper follows that of the spruce budworm by about a month and the warm, dry weather in July favored larval development and survival. The two infestations recorded in 1983 expanded considerably in 1984. In addition, separate areas of defoliation occurred in numerous locations in central and eastern Newfoundland. The total area of defoliation was approximately 95 000 ha with 53 000 ha in the moderate and severe category and the remaining 42 000 ha in the light defoliation class. No tree mortality was caused by the hemlock looper defoliation on the Island in 1984. No looper larvae were collected in Labrador in 1984.

Larval and pupal parasitism of the looper averaged 35% and 10% respectively. Disease organisms were not observed in laboratory rearings or in the field samples.

Based on the distribution of severe defoliation and subsequent intensive larval and egg sampling in most of the immature and mature forested areas of the Island, moderate and severe defoliation is forecast to occur on about 273 000 ha in 1985, most of it distributed in central Newfoundland and on the Avalon Peninsula. Light defoliation is expected to occur on about 437 000 ha distributed in many isolated areas throughout the Island.

Decline and Dieback and Stress Related Disorders

Oak Decline

For some years oak decline and mortality have been recorded in a number of areas in southern Ontario. A major factor in this decline condition is the oak leaf shredder, *Croesia semipurpurana* (Kft.). Since 1977 the Ontario FIDS Unit has maintained 13 permanent sample plots in southern Ontario in an effort to chart the course of the condition and, if possible, to determine some of the factors involved. Initially 100 live trees were tagged in each plot. In the past eight years, 125 or 9.6% of tne original 1300 trees have died. This fact notwithstanding, a general improvement has been observed in the status of the remaining trees for the past two years. This improvement coincides with a substantial decline in oak leaf shredder populations.

Oak Dieback

In 1983, isolated cases were reported of mortality and dieback among oaks in the Ottawa Valley. In order to specify the geographic distribution of this phenomenon and the possible causal agents, a special survey of oak was conducted in 1984 in stands throughout Quebec.

Fifty-seven oak stands along the southern part of the St. Lawrence and Ottawa valleys were mapped for assessment of insect and disease conditions. The predominant species in these stands is red oak. Bur oak, white oak, and blue oak are also present in some, along with other deciduous species and, occasionally, white pine.

Of the 57 stands visited, 24 were assessed for dieback. In each location, 100 trees (divided into 5 groups of 20) were selected at random and individually examined for crown dieback. Samples of dead and dying branches were collected and sent to the LFRC disease diagnosis laboratory for identification of causal agents.

Results of the survey indicate varying levels of dieback in four out of five oak stands in Quebec. Two-thirds of the oak stands showed light-to-moderate dieback. Two stands, in a group of five without apparent symptoms, were located close to stands with severe dieback. Four oak stands showed severe dieback, two of them with 10 to 12% mortality. These were located along the southern border of Quebec.

The three most common fungi found on oak twigs affected by dieback are, in order of importance, *Botryosphaeria quercuum* (Schw.) Sacc., *Pseudovalsa longipes* (Tul.) Sacc., and *Botryosphaeria melanops* (Tul.) Winter. *B. quercuum* is a secondary parasite, that is, one which attacks trees already weakened by another agent; the role of the other two fungi has not yet been clarified, although they are usually considered saprophytic. Based on the results of studies conducted in the United States, the presence of *B. quercuum* would seem to indicate that oaks in Quebec suffered major stress a few years ago. This fungus is one of the organisms that can play an active role in the complex process of dieback in oak. Drought is recognized as an important factor in the susceptibility of oak to dieback; the American studies show that a shortage of nutrients and major temperature variations play a lesser role, but are also significant.

It is important to note that in 1981 Quebec suffered unusual climatic conditions which caused mortality in a large number of apple trees. That same year, we observed considerable damage by *Nectria cinnabarina* (Tode ex Fr.) Fr., a secondary parasite that attacks many hosts, in particular deciduous tree species. Futhermore, numerous cases of dieback were reported in maple stands the following year. The oaks may therefore have been susceptible to attack by this fungus as a result of these climatic conditions, although experiments would have to be conducted to verify this hypothesis.

As part of the special survey on oak, we examined 55 of the 57 stands mentioned above specifically for insects: 24 stands were visited three times (in June, July, and August) and 31 were visited in July only. The predominant species involved was red oak, but bur oak, white oak, and blue oak were also present.

Since 1956, annual surveys have identified 175 insect species which attack mainly red oak. Of these, 62 were collected in the 1984 survey, along with several gall-making species, as yet unidentified. However, none of these, either individually or collectively, caused significant damage in 1984. Defoliation did not exceed 15%.

Maple Dieback

In response to various concerns, the Ontario FIDS Unit conducted a maple dieback survey in southern Ontario in 1984. A minimum of 100 sugar maple trees were examined in each of 34 randomly selected stands and rated for dieback symptoms. Of the 3 822 trees thus rated, 236 or 6.2% had severe dieback symptoms, i.e., greater than 25% crown dieback. Another 629 or 16.5% showed minor dieback symptoms. The number of trees with severe crown dieback ranged from 0 to 56% within the 34 plots. The most severe damage was recorded in plots in Cardiff Township, Bancroft District (46.6%), Peck Township, Algonquin Park District (56.1%), Williamsburgh Township, Cornwall District (31.6%) and Alfred Township, Cornwall District (27.7%). Ten to twenty percent of the trees in five of the remaining plots had severe crown dieback. From zero to ten percent of the trees in the remaining plots had severe crown dieback.

Drought Damage

The lingering effects of the 1983 drought were evident in a number of areas in southern Ontario. Reduced growth, stunted foliage, twig and branch dieback and, in some cases, whole tree mortality were recorded within a total area of 5 800 ha in the Algonquin and Eastern regions. For the most part, the trees were growing on poor sites with shallow soils, such as rocky ridges, lakeshores or limestone flats. The species most often affected were red oak, white and yellow birch, trembling aspen and sugar maple.

Acid Rain National Early Warning System

"Acid rain" has become the popular generic term encompassing all forms of air pollution — wet precipitation, dry deposition, ambient gaseous concentrations of pollutants, and airborne particulates including heavy metals. These pollutants, alone or in combination, may directly or indirectly affect the health of Canada's forests, their normal development, the production of wood, or the forests' role in providing a healthy environment.

Unlike the case for aquatic systems, evidence of damage to forests directly attributable to acid deposition has not been observed in Canada, except near strong point sources of emission. Nevertheless, the fact that 55% of the 71 million ha of productive and accessible eastern Canadian forest is exposed to substantial quantities of acid deposition has caused the Canadian Forestry Service to increase its effort to monitor the threat of acid rain and airborne pollutants to Canada's forests.

Acid rain is highly suspect as a causative factor of the widespread forest damage observed in central Europe and parts of the U.S. Northwest. The forests of central Europe are well tended and diseased trees are methodically removed, whereas Canada's forests are largely natural. Therefore, it is expected that identifying the early stages of pollution damage as distinct from entomological and pathological damage would be extremely difficult, because of the inherent "background noise" or condition of a natural forest. For this reason, it has become necessary to establish a network of permanent plots to detect accurately the early signs of acid rain damage to Canada's forests.

The network of plots, together with the integration of available information from all sources on acid rain and air pollutants in Canada, has been termed the Acid Rain National Early Warning System (ARNEWS). It was established in 1984.

The objectives of the program are:

1. To detect the possible damage to forest trees and soils caused by acid rain or to identify the damages sustained by Canadian forests (trees and soils) which are not attributable to natural causes or management practices;

2. Long term monitoring of vegetation and soils to detect future changes attributable to acid deposition and other air pollutants in representative forest ecosystems.

Permanent plots are maintained in all regions of Canada (Figs. 11 and 12) to monitor:

1. the condition and changes in the condition of the forest stand;
2. the presence and fluctuation of biotic and abiotic factors that affect the condition of the forest (insects, diseases, stand changes, temperature, etc.);
3. the changes and symptoms that indicate factors not attributable to the above that could conceivably be early signs of acid rain damage;
4. effects of acid rain on the condition of the various economically important tree species.

Newfoundland

Ten acid rain plots were established throughout the Island in 1984 to measure the effect of acid rain on the forests of Newfoundland. Samples were collected from an area adjacent to the plot for examination and analysis at the laboratory. Annual checks will be continued to monitor any changes in trees in those plots.

Maritime Provinces

In the Maritimes Region, 15 permanent ARNEWS plots, representing the important forest species and geographical areas, were established in 1984.

In addition to the work on permanent plots, the "signs of possible acid rain damage" were recorded for most of the 278 locations where detailed pest condition assessments were made. Special attention was directed to the "number of years of needle retention" on coniferous species. Forest Insect and Disease Survey personnel are always on the lookout for "unusual" or "unexplained" forest conditions, some of which may be suspects for acid rain damage.

Information collected is under analysis and results will be reported through appropriate channels when they become available.

Quebec

In the Quebec region, 13 plots out of the 25 planned were established in 1984. The plots were selected based on the economic importance of the tree species present, the quantity of acid precipitation and the relative sensitivity of the soil. Major species represented in the plots established are balsam fir, white spruce, black spruce, red spruce, jack pine, red oak, and sugar maple. Other species of economic importance that occupy more than 20% of the stand will also be monitored. The remaining 12 plots will be established in 1985.

Ontario

In keeping with its new role as part of a national early warning system for acid rain, the Ontario FIDS Unit established 13 of a planned 35 monitoring plots across the province in 1984. The plots have been marked, and the trees numbered and mapped. Such parameters as vertical and radial growth, crown structure and density, mortality and incidence of insect and disease attack have been measured. Further work including soil sampling and foliage analysis is planned for 1985. Established plots contained the following tree species: black spruce, white spruce, sugar maple, jack pine, yellow birch and white pine.

British Columbia

Because rainfalls as acidic as pH 4.6 are being recorded when storm fronts move into southwestern British Columbia through the Puget Sound, and because some sensitive soils have low buffering capacity, the potential for forest damage in western North America is clearly recognized.

Three CFS-FIDS Acid Rain National Early Warning System (ARNEWS) permanent plots have been established in British Columbia: near Shawnigan Lake, on Saltspring Island, and in the U.B.C. Research Forest. These areas were selected partly because of the availability of related information such as tree growth, water quality, and soil chemistry. Additional plots will be established in 1985 and 1986.

To obtain a more immediate assessment of the condition of the forests in B.C., FIDS rangers made additional observations at 417 of the province-wide permanent sample sites (PSS) monitored annually for insect occurrence and population levels. Particular attention was directed to symptoms reported to be typical of acid rain damage in Germany, namely: casting of green or uncharacteristic shaped leaves, premature discoloration and shedding of needles, unexplained dieback, early flattening of tree crowns ("storks nesting"), abrupt decline in foliage or annual ring growth, etc. Site assessments were distributed among the soil sensitivity zones with 19% low, 17% moderate, and 64% high. Site distribution by wet sulphate deposition zone was 17% with 20–30 kg/ha/yr, 17% with 10–20 kg/ha/yr and 66% with less than 10 kg/ha/yr.

Trees were healthy at 80% of the PSSs. At 20% of the sites, mainly in the West Kootenay, trees had thin crowns (frequently because of current or recent insect feeding or needle casts) or flat tops usually associated with stand maturity. Some level of insect or disease activity was recorded at 40% of the sites. At least 20 tree species and numerous ground cover species were observed. Needle retention averaged 3 to 5 years, generally depending on species. Although long-term or indirect effects may be accumulating, all obvious damage encountered could be accounted for by current or previous pest conditions.

Three acid rain-related contracts are now in progress. The collected soil and foliar samples are being analyzed to determine the concentrations of key elements such as nitrogen, phosphorus, potassium, calcium, magnesium, aluminum, iron, copper, zinc, and manganese. A 13-year historical record of water quantity, quality, and chemistry for one selected study area is being summarized through a second contract. With the many recent and widely varied initiatives in acid rain research and monitoring throughout British Columbia and the U.S. Pacific Northwest, the need for an index of scientists, agencies and studies is clearly necessary; its compilation is in progress through the third contract.

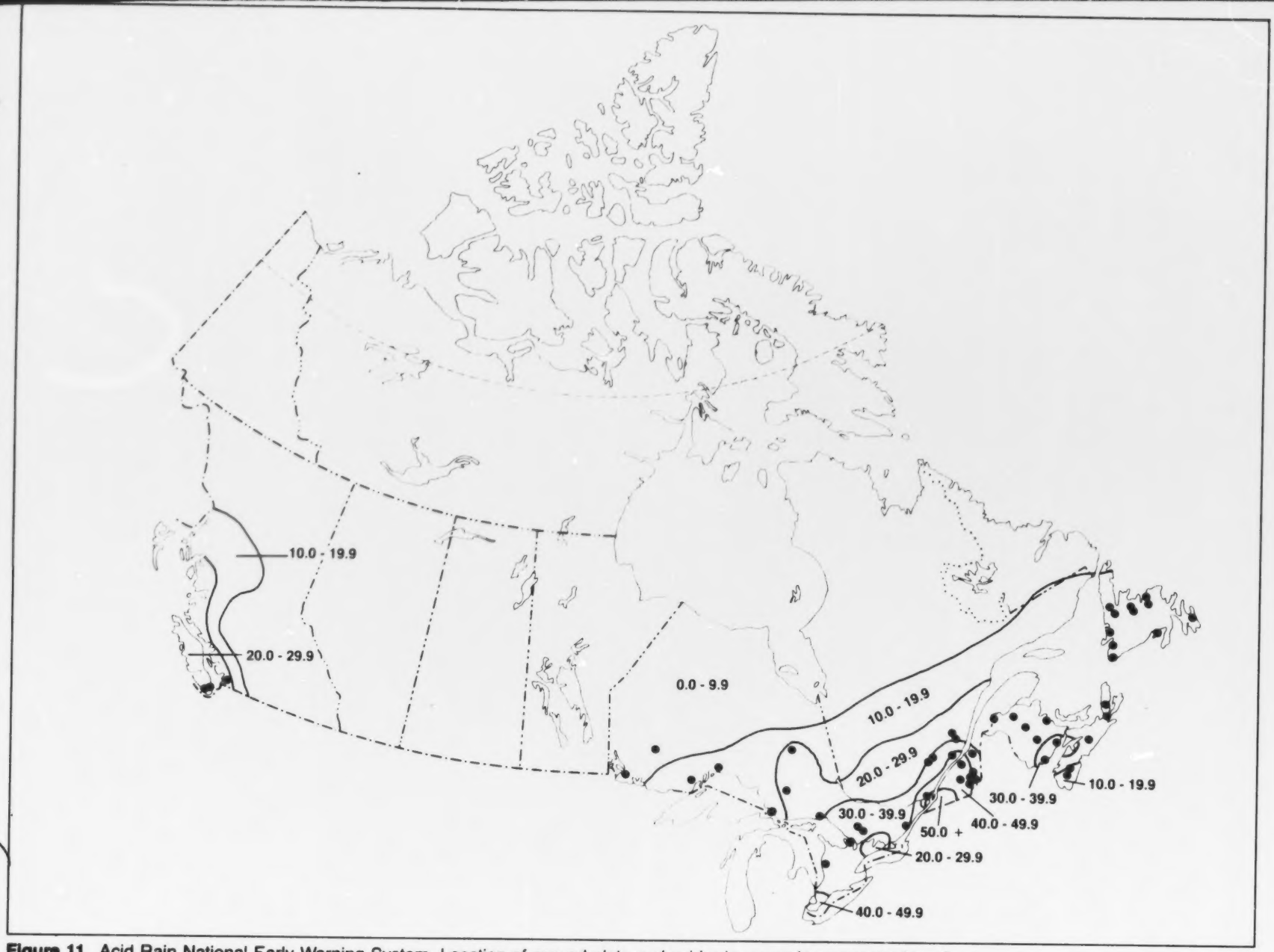


Figure 11. Acid Rain National Early Warning System. Location of ground plots and acid rain zones by concentration of SO_4 (kg/ha/yr) deposition.

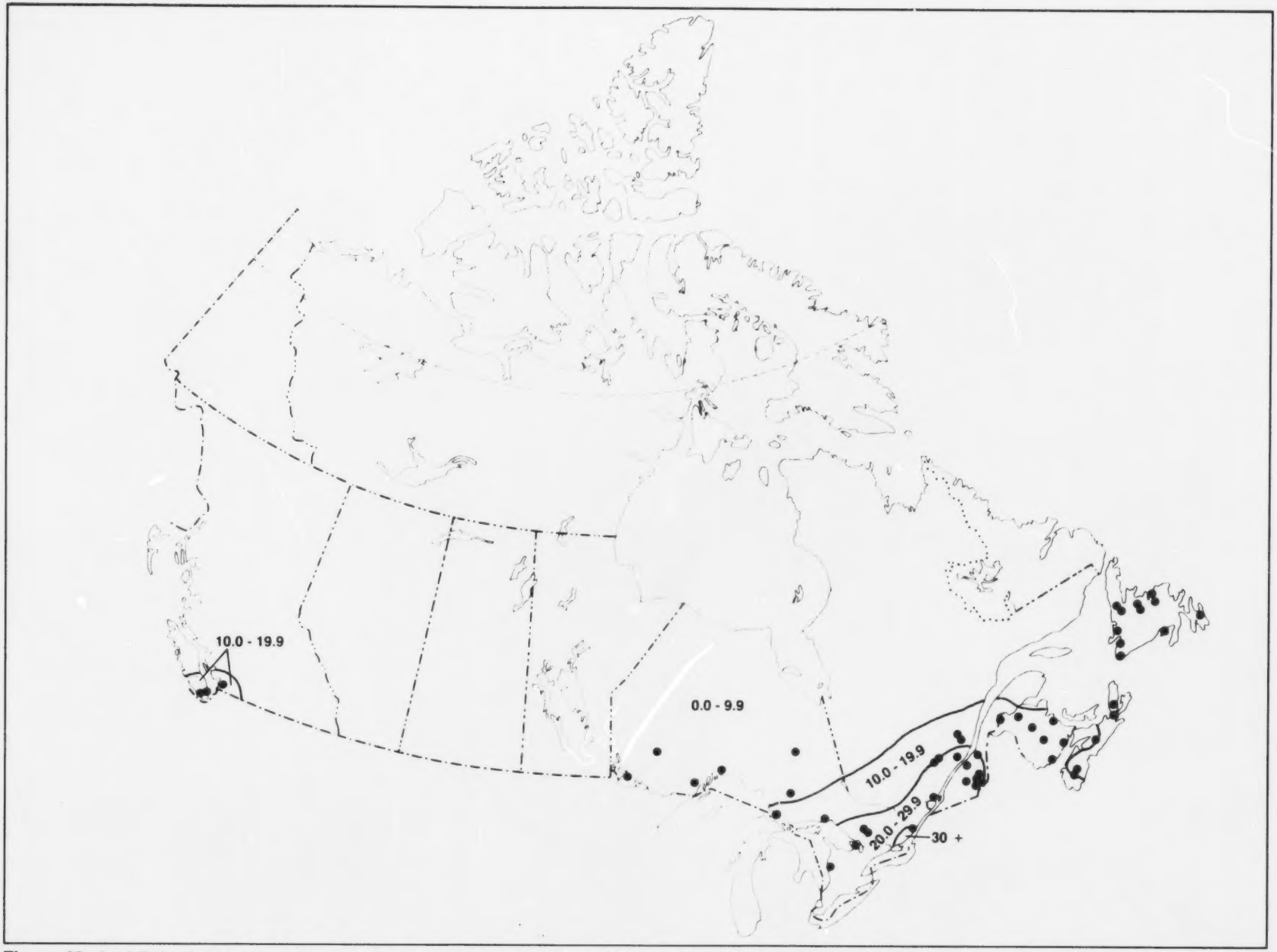


Figure 12. Acid Rain National Early Warning System. Location of ground plots and acid rain zones by concentration of NO_3 (kg/ha/yr) deposition.

Special Surveys

Cone and Seed Pests

Newfoundland

Collections of cones during the past three years have produced several species of cone and seed insects. Light-to-moderate damage of cone crops occurred this year in the Noel Paul's Brook, New Bay Lake, and Aspen Brook areas. Light damage was also reported along the Churchill River Road in Labrador. Most of the damage occurred on black spruce cones.

Low incidence of cone rust caused by *Chrysomyxa pirolata* Wint. was recorded on black spruce regeneration near Burnt Berry Pond. In St. John's, the disease was observed on ornamental white spruce. About 10% of the cones on a few trees were affected.

New Brunswick

Cone rusts, because of their potential to interfere with seed production, are among those forest diseases that have a direct impact on all aspects of forestry in both the short and the long term. In 1984 cone rusts proved to be one of the major forest disease problems of white spruce in New Brunswick.

The fungus, *Pucciniastrum americanum* (Farl.) Arth., has been previously reported on cone scales in Canada only in British Columbia in 1962 and New Brunswick in 1982 and 1983. In the past it has been considered a needle or cone rust of no significance. In 1984 there was a bumper cone crop on white spruce in New Brunswick and the weather was wet and humid in the early part of the season. The combination of the presence of cones, ideal conditions for spore germination, and the abundance of raspberry (the alternate host required by *P. americanum* to complete its life cycle) resulted in very high levels of infection of white spruce cones throughout much of New Brunswick (Fig. 13). In some areas the infection was so heavy that the tops of trees actually appeared yellow from a distance because of the generous production of spores.

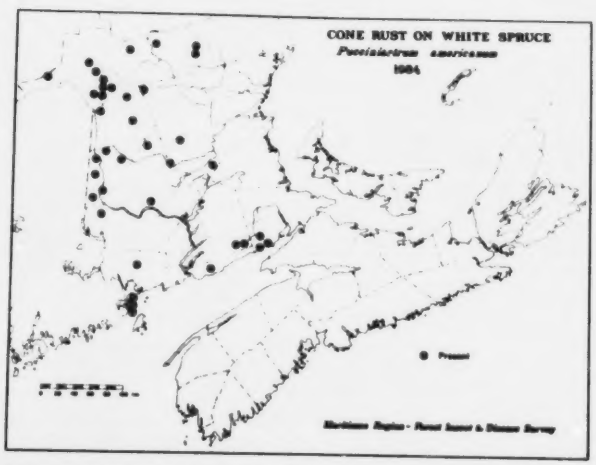


Figure 13. Locations of cone rust on white spruce.

Of 49 areas surveyed for cone rust, the fungus was found in 46; the incidence of infected cones in these 46 areas was 57.7% (range 1% to 100% of cones infected). This figure is based on the examination of an average of 135 cones per location (range 18 – 300 cones). The severity of infection on individual cones varied greatly from a single infection spot affecting 1–3 cone scales, to as much as 75% of the cone surface covered by the fungus. In general, heavily infected cones were smaller than normal, appeared withered and many were later overgrown by secondary fungi. The effects of infection on seed production and viability are under investigation.

The fungus, *Chrysomyxa pirolata* Wint. completely penetrates infected cones and prevents seed development. This rust, which alternates to *Pyrolae* or *Monesis* to complete its life cycle, was found at 9 of the 36 white spruce areas assessed. The incidence was low (2% or less of the cones destroyed at most locations) except at Biard, Madawaska County, N.B., where 9% of the cones examined were affected.

Quebec

In 1982, the heightened interest in reforestation in Quebec led the FIDS-LFRC to begin a special survey of insects which attack the flowers, cones and seeds of fir; white, red and black spruce; tamarack, and western and Japanese larch.

In general, sites in which samples of flowers and cones were collected were of two types: those with *visible* damage by spruce budworm, and those with little or no *apparent* damage by the budworm. This double sampling could be done only for certain species. In most cases, three collections were made: (1) male and female inflorescences (spring); (2) young cones (July); and (3) mature cones (August).

Results are not yet complete, however, included are summary lists of the various insect species indentified to date (10 000 rearing specimens) to give an indication of the results that can be expected.

The results of inflorescence surveys and rearings show that a wide range of insects attack fir, fewer attack white spruce, and very few attack the other species surveyed. The spruce budworm is by far the most common, and is twice as numerous in fir inflorescences collected in SBW-infested plots as in those from other locations. This trend was also observed for the white spruce, which had a ratio of 4 to 1. Below is a partial list of the insect species obtained in order of decreasing importance.

Fir

Choristoneura fumiferana
Dioryctria reniculelloides
Pulicalvaria piceaella
Eupithecia transcanadata

Nyctobia limitaria
Acleris variana
Mindarus abietinus
Contarinia sp.

White Spruce
Choristoneura fumiferana
Pulicalvaria piceaella
Zeiraphera canadensis
Griselda radicana
Archips packardiana
Rhabdophaga swainei

Black Spruce
Choristoneura fumiferana
Dioryctria reniculelloides

Red Spruce
Choristoneura fumiferana
Griselda radicana
Dioryctria reniculelloides

Norway Spruce
Choristoneura fumiferana
Dioryctria reniculelloides
Zeiraphera canadensis

Ash
Adelges lariciatus

Often, the insects which had caused the damage had disappeared before the inflorescences were collected. Furthermore, some of the specimens reared did not survive until emergence.

Among the wide range of cone pests, the spruce budworm is always prominent, but is usually second in numbers, and is found only in sites visibly affected by SBW.

Table 2. Major cone and seed pests collected during survey, Quebec 1982

Host species	Cone pests	Seed pests
Fir	*Dioryctria abietivorella* *Choristoneura fumiferana* *Dioryctria reniculelloides* *Barbara mappana* *Holcocera immaculella* *Hylemya abietis* *Earomyia* prob. *aterrima*	*Megastigmus specularis* *Bradysia* sp. *Earomyia aterrima* *Mesopolobus* sp. *Habrocytus* sp. *Gaurax atripalpus* *Fiebrigella* sp. *Cecidomyia* sp. *Platygaster contorticornis*
White spruce	*Cydia youngana* *Choristoneura fumiferana* *Dioryctria abietivorella* *Dioryctria reniculelloides* *Hylemya anthracina* *Holcocera immaculella* *Polychrosis piceana*	*Cydia youngana* *Dasineura rachiphaga* *Bradysia* sp. *Megastigmus atedius* *Dioryctria abietivorella*
Red spruce	*Cydia youngana* *Hylemya anthracina*	*Cydia youngana* *Dasineura rachiphaga*
Black spruce	—	*Dasineura rachiphaga*
Tamarack	—	*Resseliella* sp. *Megastigmus laricis* *Adelges lariciatus* *Hylemya* prob. *laricicola* *Endopiza piceana*

British Columbia

Cone crops in coastal and interior stands were greatly reduced from 1983. This resulted in increased infestations by cone and seed pests which severely affected the light, scattered cone crops.

Most of the Douglas-fir cones (avg 94%, range 78 to 100%) in four areas in the East Kootenay and in six stands in the West Kootenay (26%, range 12 to 38%) of the Nelson Region were infested. The major pest was a cone moth *Barbara colfaxiana* (Kft.) with lesser quantities of a cone gall midge, *Contarinia oregonensis* Foote, a cone scale midge, *C. washingtonensis* Johns., a cone moth, *Dioryctria abietivorella* (Grt.), and a seed chalcid, *Megastigmus spermatofrophus* Wachtl.

A cone disease, *Sirococcus strobilinus* Preuss, frequently a serious blight of spruce and pine container stock, infected 65% of the few scattered white spruce cones at Chetwynd in the Prince George Region. Inland spruce cone rust, *Chrysomyxa pirolata* Wint., infected 4% of the very light Engelmann spruce cone crop near Nakusp in the Nelson Region, and 25% of the white spruce cones in a seed orchard near Salmon Arm in the Kamloops Region.

Pests in Young Stands and Plantations

Newfoundland

Damage by the spruce bud midge, *Rhabdophaga swainei* Felt, was recorded in young black spruce and white spruce regeneration throughout the Island. Population levels were high in several locations causing multiple tops in many young trees. Permanent sample plots were established in several infected areas on the Island to study the biology of the pest and to assess the effect of damage on tree form and growth.

Quebec

Over the past ten years, numerous FIDS surveys of white pine blister rust (*Cronartium ribicola* J.C. Fisch.) in natural stands have shown that white pines throughout Quebec are susceptible to the disease, and that the infection level is anywhere from 5 to 12% of the stems. Surveys conducted in plantations are much fewer in number, and reveal greater losses over smaller areas. In an effort to better characterize the preferred sites of this rust, the FIDS-LFRC conducted special surveys in 88 study plots. About 82% of the surveys, each of which covered from 100 to 160 trees, were conducted in natural forests. An analysis of the results showed that surveys which recorded the highest infection level (over 12% of the stems affected) were often conducted on slopes at altitudes above 200 m, while those which recorded the lowest infection level (0 to 4%) were often conducted on flat ground at altitudes below 125 m. In plantations, some of the high infection levels can be explained by the above-mentioned factors, but in certain locations other factors must also be considered, such as the abundance of intermediate hosts (*Ribes* spp.), the presence of failed areas in the plantation, or poor seed quality. All these factors were considered in this survey, but their impact was too varied to generalize.

The zones where the white pine is vulnerable to blister rust in Quebec were first mapped ten years ago. These will be revised in the light of the new data obtained during this and other surveys conducted by the FIDS since that time. A report currently being prepared by the LFRC will describe the optimum site conditions for the establishment of a white pine plantation less vulnerable to blister rust and the weevil.

The white pine weevil, *Pissodes strobi* (Peck), also causes considerable damage to the white pine; consequently, new and previous attacks of this pest were noted during the survey. Attacks were recorded in only 15% of the 88 study plots, probably because observations were made mainly in natural stands aged from 20 to 40 years. Too few assessments were made in plantations to determine their susceptibility to attack by this pest.

Ontario

Special surveys in 1984 concentrated on white spruce plantations. This was part of a continuing program to evaluate and gather baseline data on a variety of pests affecting conifer plantations in the province. Some 10 500 trees were examined in 70 plantations.

The results of the insect part of the survey follow. The spruce budworm, *Choristoneura fumiferana* Clem., was the most abundant and important insect encountered in the survey. It was found in 47 plantations infesting 2 571 trees or 24.5% of the total. The spruce coneworm, *Dioryctria reniculelloides* Mut. & Mun., often feeds in conjunction with the spruce budworm, and defoliation by the two must therefore be grouped. The coneworm was found on 241 trees or 2.3% of the total. The combined defoliation by the two insects averaged 7% per infested tree. Most plantations affected by the spruce budworm including those most heavily infested were located in the Northern, Northeastern and North Central regions.

The second most abundant insect was the spruce budmoth, *Zeiraphera* spp., which was found in 27 plantations infesting 1 273 trees or 12.1% of the total. It was found mainly in the Northwestern, Northern, Algonquin, Central and Southwestern regions.

The yellowheaded spruce sawfly, *Pikonema alaskensis* (Roh.), occurred in 21 plantations affecting 395 trees, or 3.8% of the total. In most cases, average defoliation was less than 10%. However, at one location in the Northwestern Region defoliation of infested trees averaged 32%.

The other major insect which was specifically surveyed for was the white pine weevil, *Pissodes strobi* Peck. It was found in ten plantations infesting a total of 19 trees (1.8%). Some 14 other insect pests were encountered in the course of the survey but damage in all cases was negligible.

The results of the disease part of the survey follow. The most abundant diseases encountered were the spruce needle rusts, *Chrysomyxa ledi* (Alb. & Schw.) de By and *C. ledicola* Lagerh., which infested a total of 1 713 trees or 16.3%, in 16 plantations. However, except for two plantations in the Northwestern Region and one in the North Central Region, actual foliage damage was less than 5%. Foliage damage in these three plantations ranged from 20 to 45%. Frost damage was recorded on 1 082 trees or 10% of the total. In most cases actual foliage damage was less than 10% except for one plantation in the Northern Region where 63% foliage damage occurred. Armillaria root rot, *Armillaria mellea* (Vahl ex Fr.) Kummer, was found on five trees and chlorotic foliage was recorded on 11 trees.

British Columbia

Mortality of spruce, Douglas-fir, and pine caused by root rots such as *Polyporus tomentosus* Fr., *Armillaria ostoyae* (= *mellea*) [Romagn.] Herink, *Verticicladiella wageneri* Kendrick and *Phellinus weirii* (Murr.) Gilbertson, remains widespread and economically important throughout British Columbia.

Infection by *P. tomentosus* root rot varied widely but averaged 35% of the mature spruce in 28 stands surveyed in northern British Columbia and the Yukon Territory. Also, advanced decay was frequently evident in recent windthrown spruce along roads and cut blocks. In nine 13- to 24-year old spruce plantations surveyed near Babine Lake, 5% of the trees were infected. Many of the most severely decayed trees were adjacent to old infected stumps.

Pest conditions were assessed at 17 sites in support of Environment 2000 projects administered by CFS. The major problems were root rots.

A brown cubical butt rot, *Polyporus sericeomollis* Rom., infected 90% of the 40-year old western red cedar on about 6 ha of a 29-ha spaced, mixed stand near Enderby. More than 50% of the heartwood was decayed at the butt level of most cedar trees. It was recommended that infected standing cedar be removed and replaced with other species including lodgepole pine.

About 50% of the mature Douglas-fir in mixed stands north of Golden was infected by Armillaria root rot, *Armillaria ostoyae*, which was first identified as a problem in the area in 1979. Western larch, which is less susceptible, has now been planted in the infected stands.

Pests of less current or little concern included *Arceuthobium tsugense* (Rosendahl) G.N. Jones, which was culled from 35 ha in a mixed stand near Comox. Sitka spruce weevil (same as white pine weevil), *Pissodes strobi* (Peck) in 2% of the leaders of 12- to 15-year-old trees in two spaced stands near Kitimat and Terrace could intensify and should be monitored. A root collar weevil, *Hylobius warreni* Wood, in less than 1% of the 7-year-old spaced lodgepole pine stand near Golden could increase following the spacing. Pine needle diseases, *Lophodermella* spp. moderately infected up to 30% of the 1983 needles of most residual lodgepole pine in two spaced stands near Golden. About 2% of the branches of residual 5-year-old lodgepole pine in a 30-ha spaced stand near Canal Flats were infected by western gall rust, *Endocronartium harknessii* (J.P. Moore) Y. Hirat., which could have been removed during spacing. In an adjacent spaced stand, Rhabdocline needle disease *Rhabdocline pseudotsugae* Syd., infected up to 40% of the 1984 needles. Swiss needle cast, *Phaeocryptopus gaeumannii* (Rohde) Petr., lightly infected older needles on 10% of the spaced immature Douglas-fir in a 35-ha stand near Comox. Foliar diseases, while decreasing growth, should not be serious unless repeated and severe over several years.

The majority of the implemented stand treatments were generally satisfactory at the time of examination. However, increased recognition of forest pests, particularly perennial diseases in young stands scheduled for spacing, could prevent spread of infection and enhance the quality of residual trees.

Root Rots

Newfoundland

Assessments were continued of the role of armillaria root rot, *Armillaria mellea* (Vahl ex Fr.) Kummer, in the mortality of black spruce stands previously defoliated by the spruce budworm in central Newfoundland. The roots of black spruce trees in a 20- to 30-year-old stand moderately damaged by the spruce budworm were exposed hydraulically and examined for Armillaria root rot. Tree mortality was about 10% but the root rot was present in 14% of the living trees.

Other Insects and Diseases

Newfoundland Region

Insect or Disease	Host(s)	Location	Remarks
Alder leaf beetle *Chrysomela mainensis mainensis* Bech	Alder	Western Newfoundland	Low populations and light defoliation.
Anthracnose *Kabatiella apocrypta* (Ell. & Ev.) Arx.	Red maple	Western Newfoundland	Twenty percent of the foliage affected on most of the seedlings.
Balsam fir sawfly *Neodiprion abietis* complex	Balsam fir Black spruce	Western Newfoundland, Labrador	Low populations.
Balsam twig aphid *Mindarus abietinus* Koch	Balsam fir	Western and central Newfoundland	Low-to-high population levels.
Balsam woolly aphid *Adelges piceae* (Ratz)	Balsam fir	Western Newfoundland	Noticeable increase in damage to immature balsam fir in recent years. Moderate-to-severely deformed crowns are common and widespread in many areas.
Birch casebearer *Coleophora serratella* (L.)	Birch	Throughout Newfoundland	High populations from the Avalon Peninsula to Gander, in the Springdale area and on the Baie Verte Peninsula. Light-to-moderate populations throughout the remainder of Newfoundland. Although the casebearer can completely defoliate white birch trees the insect rarely causes tree mortality.
Birch leafminer *Fenusa pusilla* (Lep.)	White birch Speckled alder Mountain birch	Western Newfoundland, Bonavista Peninsula, Labrador	Low-to-high populations. Light-to-severe defoliation.
Black army cutworm *Actebia fennica* (Tausch.)	Pin cherry Fireweed Black spruce	Central Newfoundland	Low numbers. Light defoliation.
Black knot *Apiosporina morbosa* (Schw.) Arx.	Pin cherry Choke cherry Black cherry Plum	Western Newfoundland, Avalon Peninsula, eastern Newfoundland	High incidence in western Nfld. where 70% of the pin cherry in a stand were affected.
Blister rust *Cronartium ribicola* J.C. Fischer	Eastern white pine Western white pine Gooseberry	Western and central Newfoundland, Avalon Peninsula	Generally low-to-moderate incidence; 10% of western white pine affected in an arboretum in western Newfoundland.
Brown felt blight *Herpotrichia juniperi* (Duby) Petr.	Black spruce	Avalon Peninsula	New record. Low incidence.
Cone maggot *Hylemya anthracina* (Czerny)	Black spruce White spruce Balsam fir	Throughout Newfoundland, Labrador	Low populations. Light damage.
Cone rust *Chrysomyxa pirolata* Wint.	Black spruce White spruce	Central Newfoundland, Avalon Peninsula	Low incidence; 10% of cones infected.
Cytospora canker *Cytospora salicis* (Cda.) Rabh.	Weeping willow Willow	Western Newfoundland, eastern Labrador	Low incidence. Wilting of tips.
Diplodia canker *Diplodia pinea* (Desm.) Kickx	Red pine	St. John's	Low incidence; 10% of shoots affected.

Newfoundland Region

Insect or Disease	Host(s)	Location	Remarks
Dothichiza canker *Dothichiza populea* Sacc. & Briard	Lombardy poplar	Western Newfoundland, urban areas on the Avalon Peninsula	High incidence. Most trees had 80% of the crown affected which appeared healthy a few years ago.
Eastern blackheaded budworm *Acleris variana* (Fern.)	Black spruce White spruce Balsam fir	Throughout Newfoundland, Labrador	Low numbers, except one location in central Nfld. with high numbers and 15% current defoliation.
Eastern dwarf mistletoe *Arceuthobium pusillum* Pk.	Black spruce	Central Newfoundland	Continued to spread in black spruce trees that previously had no visible symptoms.
Fall webworm *Hyphantria cunea* (Drury)	Speckled alder	Western Newfoundland	Moderate populations and defoliation near Stephenville Crossing.
Four-eyed spruce bark beetle *Polygraphus rufipennis* Kby.	Black spruce	Central Newfoundland	Stands with more than 10% tree mortality totalled about 96 000 ha in 1983 and another 100 000 ha had less than 10% mortality. The areas of tree mortality did not expand in 1984 and the rate of mortality decreased from an average of 8.7% in 1983 to 4.5% in 1984.
Frost damage	All softwood and hardwood species	Throughout Newfoundland; eastern Labrador	Common and widespread affecting up to 100% of the current growth in many locations.
Ice storm damage		Eastern Newfoundland; Avalon Peninsula	An ice storm accompanied by high winds on the northern section of the Avalon Peninsula caused light-to-moderate damage to several species of trees.
Ink spot *Ciborinia whetzelii* (Seav.) Seav.	Trembling aspen	Eastern Labrador	Low incidence. Approximately 15% of the foliage affected.
Larch sawfly *Pristiphora erichsonii* (Htg.)	Tamarack	Avalon and Bonavista peninsulas; central Newfoundland	Low-to-high numbers. Defoliation ranged from 5% to 90%.
Leaf rust *Melampsora abietis-canadensis* C.A. Ludwig ex Arth.	Trembling aspen	Central Newfoundland	High incidence; 100% of the foliage affected on most of aspen regeneration.
Leaf & shoot blight *Pollaccia elegans* Serv.	Silver poplar Hybrid poplar	Western Newfoundland, Burin and Avalon peninsulas	High incidence in western Newfoundland with up to 70% of the foliage affected on ornamentals.
Venturia macularis (Fr.) E. Müll. & Arx	Trembling aspen	Throughout Newfoundland; eastern Labrador	Generally moderate incidence, affecting up to 40% of foliage on 30% of aspen.
Mountain ash sawfly *Pristiphora geniculata* (Htg.)	American mountain-ash	Western and eastern Newfoundland	Generally moderate populations. Light-to-severe defoliation.
Needle rust *Chrysomyxa ledi* (Alb. & Schw.) de By	Black spruce	Avalon Peninsula; eastern Labrador	High incidence on spruce on wet sites.
Northern spruce engraver *Ips perturbatus* (Eichh.)	Black spruce	Labrador	New record. Associated with some tree mortality.
Red banded disease *Dothistroma pini* Hulbary	Red pine Austrian pine Jack pine	Western, central and eastern Newfoundland	Generally low incidence but 20% to 90% of the foliage was affected in a 20-year-old jack pine plantation in central Newfoundland.

Newfoundland Region

Insect or Disease	Host(s)	Location	Remarks
Rusty tussock moth *Orgyia antiqua* (L.)	Balsam fir; white spruce; black spruce; tamarack; speckled alder; willow; white birch	Throughout Newfoundland	Low populations.
Satin moth *Leucoma salicis* (L.)	Willow	Corner Brook	Low-to-moderate populations. Light-to-moderate defoliation.
Shot hole *Coccomyces hiemalis* Higgins	Choke cherry Black cherry Pin cherry	Western Newfoundland; Avalon Peninsula	Low-to-moderate incidence. Up to 30% of foliage of pin cherry affected in western Newfoundland.
Sirococcus shoot blight *Sirococcus strobilinus* Preuss	Black spruce	Central Newfoundland	Trace-to-low incidence on seedlings in the nursery affected.
Spruce bark beetle *Scolytus piceae* (Sw.)	Black spruce	Labrador	New record.
Spruce cone rust *Chrysomyxa arctostaphyli* Diet.	Black spruce	Avalon Peninsula	High incidence with two to three brooms per tree.
Melampsorella caryophyllacearum Schroet.	Balsam fir	Central Newfoundland, Avalon Peninsula	High incidence on the Avalon with two to three brooms per tree.
Spruce coneworm *Dioryctria reniculelloides* Mut. & Mun.	Black spruce White spruce	Western and central Newfoundland	Low populations.
Striped alder sawfly *Hemichroa crocea* (Geoff.)	Speckled alder	Western and central Newfoundland; Bonavista Peninsula	High populations in western and central Newfoundland.
Tip blight *Rehmiellopsis balsameae* Waterman	Balsam fir	Western and eastern Newfoundland	Low-to-moderate incidence on new foliage of balsam fir regeneration.
Willow blight *Fusicladium saliciperdum* (Allesch. & Tub.) Lindau *Physalospora miyabeana* Fukushi	Weeping willow Pussy willow Laurel willow Willow	Western Newfoundland, Avalon Peninsula, eastern Labrador	A moderate incidence with up to 30% of foliage affected.
Willow leaf beetle *Chrysomela falsa* Brown	Willow	Baie Verte Peninsula, Labrador	Low-to-moderate populations. Light-to-moderate defoliation.
Willow sawfly *Nematus ventralis* Say	Willow	Throughout Newfoundland	Low-to-moderate populations. Light-to-moderate defoliation.
Winter drying	Balsam fir	Western Newfoundland, Northern and Avalon peninsulas	Low-to-moderate incidence. Up to 40% of the foliage of exposed trees affected.
Yellowheaded spruce sawfly *Pikonema alaskensis* (Roh.)	Black spruce White spruce Sitka spruce	Throughout Newfoundland	Low-to-moderate populations. Light-to-moderate defoliation.

Other Insects and Diseases

Maritimes Region

Insect or Disease	Host(s)	Location	Remarks
Alder flea beetle *Altica ambiens alni* Harr.	Alder	Maritime Provinces	Pockets of leaf browning, often of moderate or severe intensity, over much of mainland Nova Scotia. Present in Kings and Queens counties, Prince Edward Island, but at reduced levels of intensity from 1983. Common throughout Charlotte County, and severe browning at a few locations in York County, New Brunswick.
Ambermarked birch leafminer *Profenusa thomsoni* (Konow)	White birch	New Brunswick Nova Scotia	Leaf browning of moderate intensity at three locations in Restigouche County, N.B. (highest in Mount Carleton Provincial Park). Lower levels of intensity were observed at one location in Carleton County, N.B. and another in Queens County, N.S.
Anthracnose *Kabatiella apocrypta* (Ell. & Ev.) Arx	Red maple Sugar maple	Maritime Provinces	Common in western New Brunswick; reported in Colchester, Lunenburg and Annapolis counties of Nova Scotia and in Queens County, Prince Edward Island. Browning of foliage, however, was only light or trace.
Armillaria root rot *Armillaria mellea* (Vahl ex Fr.) Kummer	Conifers	Maritime Provinces	The fungus is an important part of the 'secondary organisms' complex, implicated in the mortality of spruce budworm-damaged forest stands. It is also becoming more frequent in plantations where the fungus is associated with mortality of young trees.
Ash rust *Puccinia sparganioides* Ell. & Barth.	Ash	Nova Scotia	Infections widespread and often severe or moderate throughout western Nova Scotia. Twig and branch mortality resulted from repeated attacks in some communities.
Aspen leafroller *Pseudexentera oregonana* Wlsm. Birch-aspen leafroller *Epinotia solandriana* L. Darkheaded aspen leafroller *Anacampsis innocuella* (Zell.) Large aspen tortrix *Choristoneura conflictana* (Wlk.) Lightheaded aspen leafroller *Compsolechia niveopulvella* (Cham.) Spotted aspen leafroller *Sciaphila duplex* (Wlsm.)	Largetooth aspen Trembling aspen	Maritime Provinces	Leafrollers present at scattered locations throughout the Region. Damage did not exceed light.
Aspen skeletonizer *Phratora purpurea purpurea* Brown	Trembling aspen	Nova Scotia Prince Edward Island	Low populations at isolated locations in each of the three counties in Prince Edward Island and at one location in Annapolis County, Nova Scotia.
Aspen webworms *Tetralopha aplastella* (Hulst) and *Meroptera pravella* (Grt.)	Trembling aspen	Maritime Provinces	Feeding in areas of forest tent caterpillar outbreak, causing browning of remaining leaves and probably contributing to stress of trees. As many as 77% of remaining leaves were brown at one location in Prince Edward Island.
Bagworm *Thyridopteryx* *ephemeraeformis* (Haw.)	Cedar	New Brunswick	Found on a pyramidal cedar at Perth-Andover, Victoria County. New record for the region.

Maritimes Region

Insect or Disease	Host(s)	Location	Remarks
Balsam gall midge *Paradiplosis tumifex* Gagné	Balsam fir	Maritime Provinces	Widespread in the Region with extremely variable infestation levels. The highest incidence (39% of needles/tree affected) was observed in a cultivated Christmas tree area in Halifax County, N.S.
Balsam twig aphid *Mindarus abietinus* Koch.	Balsam fir	New Brunswick Nova Scotia	Widespread in northern New Brunswick and in western Nova Scotia and also in Guysborough County, N.S. Infestation levels were generally low. However, as many as 78% and 47%, respectively, of branches were affected in New Brunswick and Nova Scotia at isolated locations.
Bark weevil *Hylobius congener* D.T.	Black spruce Red pine Scotch pine White spruce	Nova Scotia	Extensive mortality of newly transplanted trees in some plantations in Antigonish and Guysborough counties. The role of this insect, implicated as the organism responsible, will be subject to further investigation in 1985.
Birch ambrosia beetle *Trypodendron betulae* Sw.	White birch	Maritime Provinces	A special survey was conducted to determine the status of this insect associated with dead and dying birch. Infested stands were found in a wide band parallel with the Bay of Fundy and in an area of northwestern New Brunswick.
Birch casebearer *Coleophora serratella* (L.)	Alder White birch Wire birch	Maritime Provinces	Moderate or severe leaf browning of white birch and alder in parts of southern New Brunswick, eastern Nova Scotia and in patches throughout Prince Edward Island. In Prince Edward Island, wire birch was also affected, usually to a greater degree than the other hosts.
Birch leafminer *Fenusa pusilla* (Lep.)	White birch Wire birch	Maritime Provinces	Abundant throughout the Region at various levels of intensity with more severe browning of the preferred host, wire birch.
Bronze birch borer *Agrilus anxius* Gory	White birch	Maritime Provinces	A special survey was conducted to determine the status of this insect which attacks and kills trees in a weakened condition. The first figure following the province represents the percentage of locations where the insect was found, the second figure represents the percentage of trees infested in affected areas: New Brunswick 32% and 6.9%; Nova Scotia 16% and 6.7%; Prince Edward Island 17% and 32%. Infested stands are distributed in a band parallel with the Bay of Fundy and in an area in northwestern New Brunswick.
Browning of larch shoots and branches	Tamarack	Nova Scotia Prince Edward Island	This condition, of unknown cause, reported for the first time in 1983, was much reduced in incidence and intensity and caused only light browning in a few areas of central Nova Scotia in 1984. Not found in Prince Edward Island in 1984.
Bruce spanworm *Operophtera bruceata* (Hulst)	Hardwoods	New Brunswick	More widespread than in previous years but the level of defoliation was generally still low.
Cedar leafminers *Argyresthia aureoargentella* Brower *A. freyella* Wlshm. *A. thuiella* (Pack.) *Pulicalvaria thujaella* (Kft.)	Cedar	Prince Edward Island	The intensity of leaf browning much reduced from that of previous years in Prince County.

Maritimes Region

Insect or Disease	Host(s)	Location	Remarks
Cedar tree borer *Semanotus ligneus* (F.)	Cedar	New Brunswick	The insect has been killing trees in a 700 km² area in the northern part of the province. Further tree mortality occurred there in 1984. Trees in an area near Saint John have been deteriorating as a result of attack by this insect.
Cherry blight	Pin cherry	Maritime Provinces	Present at a few locations in western New Brunswick, and at one location in Kings County, Prince Edward Island. Much reduced from 1983.
Cherry casebearer *Coleophora pruniella* Clem.	Trembling aspen	Prince Edward Island	A few areas of severe or moderate leaf browning occurred again in the province.
Deterioration of white birch along the Bay of Fundy	White birch	New Brunswick Nova Scotia	Early foliage browning and premature leaf drop of white birch has occurred annually since 1979 along the Bay of Fundy, on a 1 to 15-km wide coastal strip and inland as far as 30 km in low lying areas. The cause of the condition is unknown but a number of factors appear to be acting together. In some years, other tree species were similarly affected but to a lesser degree.
Dieback of ash	Ash	New Brunswick	Mortality of top branches of all trees at one location, and only of older trees at two locations in northern New Brunswick.
Douglas-fir needle cast *Rhabdocline* sp. and Douglas-fir needle cast *Phaeocryptopus gaeumannii* (Rohde) Petr.	Douglas-fir	Nova Scotia	Light and moderate damage in a small plantation in Lunenburg County.
Eastern blackheaded budworm *Acleris variana* (Fern.)	Balsam fir Spruce	Maritime Provinces	Populations continue to be low.
Eastern tent caterpillar *Malacosoma americanum* (F.)	Apple Cherry Trembling aspen	Maritime Provinces	Common on roadside trees and bushes at many locations in eastern New Brunswick where counts of nests ranged as high as 13 per 100 m²; low population levels in the western part of the province. In Nova Scotia nests were plentiful in Hants County and parts of Annapolis County; present in low numbers in other areas of the province and also in Prince Edward Island.
Elm leaf beetle *Pyrrhalta luteola* (Müll.)	Elm	New Brunswick	Browning of shade trees severe for the second consecutive year in Fredericton. Also observed in two other communities.
Elm leafminer *Fenusa ulmi* Sund.	English elm	Maritime Provinces	Exotic elms in many communities throughout most of Nova Scotia, Prince Edward Island and at Sackville, New Brunswick sustained varying degrees of leaf browning, which was often moderate or severe in intensity.
European pine sawfly *Neodiprion sertifer* (Geoff.)	Red pine Scotch pine	New Brunswick Nova Scotia	Severe or moderate defoliation of ornamental trees occurred in Lunenburg and Halifax counties, Nova Scotia. The insect was also observed in Pictou and Cape Breton counties, Nova Scotia and in Westmorland County, New Brunswick

Maritimes Region

Insect or Disease	Host(s)	Location	Remarks
European pine shoot moth *Rhyacionia buoliana* (Schiff.)	Red pine Scotch pine	Nova Scotia Prince Edward Island	There was no significant increase in populations in 1984. The insect is present at varying levels of intensity, generally in the low-to-moderate range. A few notable exceptions were a plantation in Cumberland County, Nova Scotia where 92% of the trees are infested, and two Christmas tree plantations (in Colchester and in Yarmouth counties) where trees were rendered unsuitable for market as a result of severe attack.
European spruce sawfly *Gilpinia hercyniae* (Htg.)	Black spruce Red spruce White spruce	Maritime Provinces	Populations low, distributed widely throughout the region.
Fall cankerworm *Alsophila pometaria* (Harr.)	Hardwoods	Maritime Provinces	Severe defoliation of a great variety of hardwoods occurred in many areas of the region with the exception of Cape Breton Island. In many areas, fall cankerworm occurred mixed with other insects.
Fall webworm *Hyphantria cunea* (Drury)	Hardwoods	Maritime Provinces	Mainly on roadside trees and bushes throughout Prince Edward Island with a noticeable increase in Queens and Kings counties. Scattered nests were observed throughout much of mainland Nova Scotia, with an increase in incidence in the eastern part of the province. Found at one location in New Brunswick in Sunbury County.
Flood damage	Hardwoods	Southern New Brunswick	Many hardwoods had small, off-color leaves as a result of prolonged flooding of a brook.
Frost damage (late)	Balsam fir and other species	Southern New Brunswick and eastern Nova Scotia	Christmas tree plantations and/or natural regeneration were mostly affected. Severe shoot damage occurred in many areas of Inverness County, N.S. On average, 20% of new shoots were killed in nine plantations in eastern Nova Scotia. Other conifers and hardwoods were also affected in some areas.
Globose gall rust *Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka	Jack pine	Maritime Provinces	Present throughout the Maritimes, causing branch and some tree mortality in plantations.
Ice damage	Conifers Hardwoods	Nova Scotia Prince Edward Island	Accumulation of ice from freezing rain in late winter and early spring broke tops and branches. It caused different levels of damage to a variety of tree species in parts of Cape Breton Island and Colchester County in Nova Scotia. Damage in north central Prince Edward Island was restricted mainly to poplar and white birch.
Introduced pine sawfly *Diprion similis* (Htg.)	White pine	New Brunswick	Moderate defoliation of an ornamental tree in York County.
Larch casebearer *Coleophora laricella* (Hbn.)	Tamarack	Maritime Provinces	Needle mining light and/or moderate at locations scattered throughout mainland Nova Scotia and Inverness County on Cape Breton Island. Populations low in New Brunswick and Prince Edward Island.
Larch sawfly *Pristiphora erichsonii* (Htg.)	Tamarack	Maritime Provinces	Populations of this important defoliator of larch remained low throughout the region. Found at only one location in Nova Scotia, and one in Prince Edward Island.

Maritimes Region

Insect or Disease	Host(s)	Location	Remarks
Leaf blotch of horse-chestnut *Guignardia aesculi* (Pk.) V.B. Stewart	Horse-chestnut	Maritime Provinces	Moderate and severe browning of a few ornamentals in Digby and Annapolis counties, present throughout eastern Nova Scotia. Light at scattered locations throughout Prince Edward Island, except severe at Souris, Kings County. Moderate at a few locations in Charlotte and York counties, New Brunswick.
Leaf spot *Actinopelte dryina* (Sacc.) Hoehn.	Red oak	New Brunswick	Common at many locations in Charlotte County. In one area, 50–70% of the foliage of most red oak was affected.
Leaf spot *Drepanopeziza tremulae* Rimpau and Leaf rust *Melampsora medusae* Thuem.	Trembling aspen Tamarack	Maritime Provinces	Levels of infection greatly reduced from 1983. Found at only a few scattered locations.
Lesser maple spanworm *Itame pustularia* (Gn.)	Red maple	New Brunswick	After several years of very low populations there was a slight increase in insect numbers in 1983. In 1984, population levels increased further especially in the eastern part of the province. Light defoliation was observed in many areas. It appears that the buildup is very similar to that which preceded the 1972–1975 outbreak.
Maple leafroller *Cenopis acerivorana* MacK.	Red maple Sugar maple	Maritime Provinces	Populations generally low in New Brunswick and Nova Scotia. In Prince Edward Island, leafrolling was reduced to light with scattered patches of moderate rolling within the areas in Kings County reported as severe in 1983. Elsewhere in the province, light at scattered locations in western Prince County.
Mountain-ash sawfly *Pristiphora geniculata* (Htg.)	Mountain ash	Maritime Provinces	Present throughout the region causing various levels of defoliation.
Mouse and/or rabbit damage	Red pine Scotch pine Tamarack	New Brunswick Prince Edward Island	Widespread and extensive damage in plantations and windbreaks in Prince County, P.E.I. In a one-year-old plantation 94% of tamarack and 65% of red pine were killed; in a 10-year-old scotch pine plantation, 68% of the trees were killed and 11% were just damaged. In New Brunswick, 20–40% of scotch pine trees were killed in a plantation in York County.
Needle cast *Lophodermium pinastri* (Schrad. ex Hook.) Chev.	Red pine	Prince Edward Island	No additional mortality occurred in the plantations of 3–0 seedlings where 38.7% of the trees died in 1983 from a variety of causes, including needle cast. The surviving seedlings produced healthy shoots in 1984.
Needle rusts *Pucciniastrum epilobii* Otth *Pucciniastrum goeppertianum* (Kuehn) Kleb. *Uredinopsis* sp.	Balsam fir	Maritime Provinces	Widespread with variable levels of infection. Generally less than 5% of the needles affected but as many as 38% of the needles lost in a Christmas tree area in eastern Nova Scotia.

Maritimes Region

Insect or Disease	Host(s)	Location	Remarks
Needle rust *Melampsora medusae* Thuem.	Tamarack	Prince Edward Island	Found at several locations but infection levels very low.
Needle rusts *Coleosporium asterum* (Diet.) Syd. *Coleosporium viburni* Arth.	Jack pine Red pine	New Brunswick Nova Scotia	Infection levels varied in plantations, from 1% to as much as 72% of the needles in a jack pine plantation in Cumberland County, Nova Scotia.
Needle rusts *Chrysomyxa ledi* de By. *Chrysomyxa ledicola* Lagerh.	Black spruce Red spruce White spruce	Maritime Provinces	Present at scattered locations throughout but infection levels less than 5%.
Oak leafshredder *Croesia semipurpurana* (Kft.) and Oak leafroller *Pseudexentera cressoniana* Clem.	Red oak	New Brunswick Nova Scotia	The decline of populations reported in previous years continued in 1984. Although light defoliation was still widespread, moderate or severe defoliation occurred only at isolated locations. Trees in many areas of repeated defoliation are in poor shape with twig and branch mortality prevalent.
Orangehumped mapleworm *Symmerista leucitys* Francl.	Beech Sugar maple	Nova Scotia	Defoliation was severe or moderate on about 250 ha in parts of Colchester and Halifax counties where 1700 ha of defoliation occurred in 1983. Larvae were found at a few other locations in the province, but defoliation was negligible.
Poplar leaffolding sawfly *Phyllocolpa* sp.	Trembling aspen	Maritime Provinces	Present at a few locations throughout the region with the greatest concentration in Pictou County, Nova Scotia, where six counts showed an average of 13% of the leaves infested with a range of 1 to 25%.
Poplar serpentine leafminer *Phyllocnistis populiella* (Cham.)	Largetooth aspen Trembling aspen	Maritime Provinces	Present at various levels of intensity in New Brunswick but highest in the northern one-third of the province. Populations lower in the western part than in 1983. Recorded in low numbers in Hants and Annapolis counties Nova Scotia. Populations remained low in Prince Edward Island averaging less than 5% of leaves affected at eleven locations.
Porcupine damage	Balsam fir Jack pine Red pine Red spruce Tamarack White spruce	New Brunswick Nova Scotia	Porcupine damage common throughout New Brunswick and western Nova Scotia. Counts in damaged areas were: 28% of trees injured at nine locations in New Brunswick and 9% at three locations in western Nova Scotia.
Potebniamyces canker *Potebniamyces coniferarum* (Hahn) Smerlis	Tamarack	New Brunswick Prince Edward Island	Identified on a few trees from York and Carleton counties in New Brunswick and from Kings County, Prince Edward Island.
Redheaded jack pine sawfly *Neodiprion virginianus* complex	Jack pine	Nova Scotia	Light or moderate loss of old foliage in a young plantation in Pictou County and on a few trees in Colchester County.
Red pine sawfly *Neodiprion nanulus nanulus* Schedl.	Red pine	Nova Scotia	Caused various levels of defoliation of ornamentals throughout much of the province.

Maritimes Region

Insect or Disease	Host(s)	Location	Remarks
Saddled prominent *Heterocampa guttivitta* (Wlk.)	Beech	Nova Scotia	The insect, in combination with the orange-humped mapleworm, caused considerable defoliation of beech over a few hectares in Colchester County.
Salt damage	White pine	New Brunswick	Discolored lower branches of roadside trees along one of the major highways (Rt. 8).
Satin moth *Leucoma salicis* (L.)	Balsam poplar Silver poplar Trembling aspen	Maritime Provinces	Light and moderate defoliation of ornamental trees in many municipalities, particularly in western New Brunswick. Moderate and severe defoliation of approximately 10 ha of aspen in a natural forest in Northumberland County, N.B. in the area where extensive leaf skeletonizing occurred in the fall of 1983. Defoliation of ornamental poplars at various levels of intensity at locations in Hants, Digby, Inverness and Richmond counties, Nova Scotia. General reduction in population levels in Prince Edward Island with severe defoliation reported from only three locations. Found on a variety of coniferous hosts throughout much of New Brunswick and Nova Scotia, in natural forests, plantations, nurseries and on ornamentals. In New Brunswick, moderate damage occurred in a balsam fir Christmas tree plantation in Sunbury County and on a tamarack plantation in York County. In Nova Scotia needle browning at various levels of intensity was common on young larch trees in much of the eastern mainland, and parts of Cape Breton Island. The small infestations in Hants and Lunenburg counties reported in 1983 subsided and no damage was observed in 1984.
Shoot blight *Venturia macularis* (Fr.) E. Müll. & Arx	Trembling aspen	Maritime Provinces	Common throughout New Brunswick, causing light and moderate damage. Damage levels light at scattered locations in Nova Scotia and Prince Edward Island.
Sirococcus shoot blight *Sirococcus strobilinus* Preuss	Red pine Spruce	Maritime Provinces	The disease is a continuing problem in red pine plantations in Nova Scotia, on natural regeneration in the south and central part of New Brunswick, and is present in Prince Edward Island. It is a recurring problem on spruce seedlings in a forest nursery in Nova Scotia. The fungus was found on white spruce cones at 15 of 33 areas assessed in New Brunswick with an average of 25% of the cones infected (range 1 to 97%) in 1984.
Spruce bud moths *Zeiraphera canadensis* Mut. & Free. *Zeiraphera destitutana* (Wlk.)	White spruce	New Brunswick	Widespread throughout much of the province but damage highest and most obvious in the northwest where repeated defoliation and shoot distortion is causing severe tree deformation in plantations. The two insects are present in mixed populations. *Z. canadensis* is more prevalent but, in some areas in northcentral New Brunswick, the ratio is reversed in favor of *Z. destitutana*.
Storm damage	Conifers Hardwoods	Northwestern New Brunswick	Extensive damage with many trees uprooted or broken off. About 33% of mature and semimature balsam fir was windthrown in one 25-ha area.

Maritimes Region

Insect or Disease	Host(s)	Location	Remarks
Spruce coneworm *Dioryctria reniculelloides* Mut. & Mun.	Spruce	Maritime Provinces	Populations low. Collected from various locations in New Brunswick and Nova Scotia. Not found in Prince Edward Island.
Stilwell's Syndrome (sudden death of balsam fir trees)	Balsam fir	Maritime Provinces	Balsam fir trees stressed by repeated budworm defoliation are susceptible to attack by a regime of organisms normally considered to be of secondary nature. The group includes bark beetles and weevils, sawyer beetles, horntailed wood wasps, Armillaria root rot, and many others. The sudden death of balsam fir trees was first reported in 1980 in localized areas of New Brunswick. The number of trees affected has varied over the intervening years but the condition continues to persist and to become more widespread with losses accumulating. In New Brunswick red trees were common this season but were particularly prevalent in the western part of the province. In Nova Scotia scattered red trees were present in parts of Cumberland, Colchester and Halifax counties, and on the Cape Breton Highlands. Reported from one location in Queens County, Prince Edward Island.
Striped alder sawfly *Hemichroa crocea* (Geoff.)	Alder	New Brunswick Prince Edward Island	Severe defoliation in a 1-ha patch in New Brunswick and Prince Edward Island.
Uglynest caterpillar *Archips cerasivorana* (Fitch)	Cherry	Maritime Provinces	Numbers low throughout the region.
Whitemarked tussock moth *Orgyia L. leucostigma* (J.E. Smith)	Conifers Hardwoods	Maritime Provinces	Populations of this economically important forest pest remained low.
White pine blister rust *Cronartium ribicola* J.C. Fisch.	White pine	New Brunswick Nova Scotia	Present throughout. Infected seedlings in a forest nursery on Cape Breton island.
White pine needle blight	White pine	Maritime Provinces	Foliage discoloration occurred at scattered locations in York, Charlotte, Sunbury, Kent, Northumberland, Queens and Kings counties, New Brunswick at various levels of intensity. In Nova Scotia needle discoloration was found at a few locations in the western part of the province and at one location in Pictou County. This condition was generally reduced from last year in both New Brunswick and Nova Scotia and was not found in Prince Edward Island. The cause of this condition is unknown.
White pine weevil *Pissodes strobi* (Peck)	Blue spruce Mugho pine Norway spruce Scotch pine White pine White spruce	Maritime Provinces	Caused leader mortality to a variety of hosts, throughout much of the region.
Willow blight *Venturia saliciperda* Nuesch	Willow	Maritime Provinces	Present at various levels of intensity, usually on ornamentals, in many areas. Not reported from Prince Edward Island.
Willow flea weevil *Rhynchaenus rufipes* (LeC.)	Poplar Willow	Maritime Provinces	Leaf browning of varying intensity common in many areas of the Maritimes. Browning of ornamental willows severe in many communities.

Maritimes Region

Insect or Disease	Host(s)	Location	Remarks
Winter drying	Conifers	Parts of southern New Brunswick and eastern Prince Edward Island	Browning of a variety of coniferous species.
Winter moth *Operophtera brumata* (L.)	Hardwoods (mostly apple)	Nova Scotia	Defoliation increased in intensity in eastern Nova Scotia from 1983 levels and was severe or moderate at numerous locations. Populations of this pest were lower than in 1983 in the western half of the province.
Wood and/or bark boring insects *Asemum striatum* (L.) *Cydia inopiosa* (Heinr.) *Dendroctonus valens* LeC. *Filatima* sp. *Hylurgops pinifex pinifex* (Fitch) *Monochamus* sp. *Orthotomicus caelatus* (Eichh.) *Pissodes* sp. *Pityogenes plagiatus plagiatus* (LeC.) *Pityophthorus* sp.	Red pine	New Brunswick	No evidence of further decline in the plantation at Meadow Brook, Kent County where 8% mortality in 1983 resulted from activity by a complex of insects.
Yellowheaded spruce sawfly *Pikonema alaskensis* (Roh.)	Black spruce Red spruce White spruce	Maritime Provinces	Defoliation was moderate or severe in small plantations of white spruce and black spruce and light on red spruce at scattered locations in Queens County, Prince Edward Island. The insect was collected at a few locations in western Nova Scotia and at a single location without noticeable defoliation in northwestern New Brunswick.

Other Insects and Diseases

Quebec Region

Insect or Disease	Host(s)	Location	Remarks
Arborvitae leafminer *Argyresthia thuiella* (Pack.)	Eastern white cedar	Extreme southern portion of the Quebec City Census Division	Light defoliation in a 2-ha stand in Clyde Corners; severe defoliation with some mortality in a 1-ha stand in Rockburn (Huntingdon).
Aspen serpentine leafminer *Phyllocnistis populiella* (Cham.)	Trembling aspen	Gaspé Peninsula	Infestations increased between 1978 and 1983. A decline in intensity and area affected was recorded for the first time in 1984. Damage was light over 58 600 ha, moderate over 53 550 ha and severe over 67 250 ha.
		North shore of the St. Lawrence River	Infestations continued to increase to the north of Baie-Comeau. Damage was light over 17 140 ha, moderate over 13 070 ha and severe over 6 950 ha. This damage must be added to that caused by the *Lyonetia* sp. leafminer where the two insects occur together.
Balsam fir sawfly *Neodiprion abietis* (Harr.)	Balsam fir	Southern portion of the Gatineau Census Division	Visible damage over 30 km along Highway 105 between Burnet and Low; damage was most visible at Farm Point. In some locations, 70% defoliation was observed.
Beech bark disease *Nectria coccinea* (Pers. ex Fr.) var. *faginata* Lohm. Wats. & Ayres	Beech	Rimouski Census Division	Four surveys detected severe damage near St-Simon, with 32 to 80% of stems affected.
		Portneuf Census Division	The disease occurred to the south of Lac-aux-Sables, outside its known distribution zone (1980).
Birch sawfly *Arge pectoralis* (Leach)	White birch	Pontiac Census Division	Second year of infestation at the Rapid Lake Station (Cabonga reservoir in La Vérendrye Park). From 80 to 100% defoliation over an area of 4 ha.
			Regeneration severely defoliated over a 3-ha area west of Landron Lake.
Birch skeletonizer *Bucculatrix canadensisella* Cham.	White birch	Central Quebec	Populations have been increasing since 1981. Damage concentrated in the most northerly regions of the Pontiac, Montcalm, Lac-St-Jean-West and Lac-St-Jean-East census divisions. Visible damage over several km² in the Chochocouane River basin near Gremlin and Elbow lakes and the Ottawa River basin near Landron Lake. Severe damage north of Dolbeau in the Mistassibi River basin, along Highway 167 inside Chibougamau Park, and in pockets all the way to Albanel Lake. To the east of Lake St-Jean, the most damage was found north of St-David-de-Falardeau, mainly along the logging road leading to Onatchiway Lake.

Quebec Region

Insect or Disease	Host(s)	Location	Remarks
Bruce spanworm *Operophtera bruceata* (Hulst)	Pennsylvania maple Sugar maple	Pontiac and Gatineau census divisions	From 5 to 100% defoliation in several locations between Kazabazua and Campbell's Bay, at lakes Early and Moore, and near Greer Mount and Poltimore. Maples 40% defoliated in an area of 2.5 km² near East Aldfield; 95% defoliation over 100 ha near Denholm.
	Sugar maple Trembling aspen	Southeastern Quebec	From 50 to 100% defoliation in numerous maple stands, particularly in the Beauce and Frontenac census divisions and in the southern portions of the Richmond and Wolfe census divisions. Affected areas totalled 344 km² for maple and 12 km² for trembling aspen.
	Sugar maple Trembling aspen	Lower St. Lawrence and extreme western portion of Gaspé Peninsula	Total infested area dropped from 1 240 km² in 1983 to 358 km² in 1984 for trembling aspen. The most severe damage was recorded near lakes Témiscouata, Pohénégamook, and Long. Maples affected in an area of only 1 km².
	Trembling aspen	Lac-St-Jean-West Census Division	Severe defoliation in an area about 2 km² north of Roberval.
Cone rust *Chrysomyxa pirolata* Wint.	White spruce Black spruce	Northern and eastern Quebec	Little damage was detected in the 44 surveys, but the disease was observed in 1984 following a period of high cone production.
Cytospora canker *Cytospora* sp.	Tamarack		Damage was scattered.
Dermea canker *Dermea balsamea* (Pk.) Seaver	Balsam fir	Wolfe, Bonaventure, and Shefford census divisions	Mortality resulting from girdling of the root collar occurred in several plantations. In some locations, the dead trees were distributed around anthills.
Dieback	Sugar maple	Southeastern Quebec	Slight increase in dieback recorded by the Quebec Department of Energy and Resources in 149 sample plots located in 88 maple stands.
	Black ash	Bonaventure Census Division	Almost all trees along the Grande-Cascapédia River were affected. The damage was variable and no causal agent was identified.
Elm lace bug *Corythucha ulmi* O. & D.	Red elm White elm	Gatineau Census Division	Leaf browning observed along 16 km to the south of Wakefield. Damage concentrated on saplings bordering Highway 105 in several locations; 90% of leaves affected.
European canker *Nectria galligena* Bres.	White elm	Deux-Montagnes Census Division	Rare on this host, found near St-Placide.
Fall webworm *Hyphantria cunea* (Drury)	White ash Red elm	Southern and western Quebec	Populations increased for the second consecutive year. Light-to-severe defoliation between St-Eustache and Ile-des-Allumettes, between Hull and Maniwaki, and in Bois-des-Filion and Terrebone.
	Pennsylvania ash	Missisquoi Census Division	Trees more than 50% defoliated in Pigeon Hill, with an average of 5 tents per tree.
	Basswood Red elm White ash	Richelieu Census Division	Light defoliation on isolated trees in the Micocoulier Ecological Reserve.

Quebec Region

Insect or Disease	Host(s)	Location	Remarks
Ice storm damage	All trees	Mégantic and Deux-Montagnes census divisions	Light-to-moderate damage was reported in 424 maple stands near Thetford Mines and Lake Deux-Montagnes following an ice storm in mid-December 1983.
Jack pine sawfly *Neodiprion pratti banksianae* Roh.	Jack pine	Pontiac Census Division	From 10 to 50% defoliation in areas of 1 to 300 ha between Bryson and Ile-des-Allumettes. In Vinton and Freshwater on Ile-des-Allumettes, mature jack pine stands of 10 and 5 ha were 50 and 25% defoliated respectively. To the east of the Gatineau River, between Ste-Thérèse and Bouchette, defoliation varying from 10 to 20% was observed in several locations.
		Champlain Census Division	Light defoliation along Highway 40 between Champlain and Cap-de-la-Madeleine.
		St-Maurice Census Division	Partial defoliation was observed in 25 to 50% of the trees in a 10-ha area at the Gilardo dam, down from 6 000 ha in 1983.
Larch casebearer *Coleophora laricella* (Hbn.)	Tamarack	Brome Census Division	Moderate damage in a 3-ha stand on Gale Mountain.
Maple leafcutter *Paraclemensia acerifoliella* (Fitch)	Sugar maple	St-Hyacinthe and Missisquoi census divisions	Light defoliation in an area of 10 ha on Rougemont Mountain and 2 ha at Frelighsburg.
Maple webworm *Tetralopha asperatella* (Clem.)	Sugar maple	Huntingdon Census Division	Light defoliation, although some trees were 80% defoliated in St-Antoine-Abbé.
Orangehumped mapleworm *Symmerista leucitys* Franc.	Sugar maple	Portneuf Census Division	From light to moderate defoliation with pockets of severe damage in an area of 18 ha near St-Basile.
Poplar leafminer *Lyonetia* sp.	Trembling aspen	North shore of the St. Lawrence River	Found north of Baie-Comeau, in some locations together with the poplar serpentine leafminer. Damage light over 5 730 ha and moderate over 8 610 ha.
Swaine jack pine sawfly *Neodiprion swainei* Midd.	Jack pine	Outaouais Trois-Rivières Saguenay/Lac-St-Jean	Light damage over 19 688 ha. Light damage over 24 219 ha. Light damage over 6 406 ha.
Wind damage	Balsam fir	Rimouski Census Division	A very dense fir grove on 46 ha was blown down near Trinité-des-Monts.
	All trees	Compton Census Division	Severe wind damage over 175 ha northeast of East Angus was reported on July 6 and 7, 1984.
		Pontiac and Gatineau census divisions	Trees in an area of 1 925 ha were blown down by violent winds on July 15, 1984 between Ile-aux-Allumettes and Blue Sea Lake, and between lakes Welches and Bertrand.

Other Insects and Diseases

Ontario Region

Insect or Disease	Host(s)	Location	Remarks
American aspen beetle *Gonioctena americana* (Schaeff.)	Trembling aspen	Northern Region	Low populations were recorded.
		Pembroke District	An area in Buchanan Township experienced 30% defoliation.
Anthracnose *Discula aridum* Arx *Discula quercina* (West.) Arx	Ash Hickory Maple	Eastern Region	Widespread damage detected through the Region. Heavy browning of foliage occurred in Cornwall, Brockville, and Napanee districts.
Armillaria root rot *Armillaria mellea* (Vahl ex Fr.) Kumm.	Pine Spruce Cedar	Province wide	Generally light mortality of 1–2% recorded.
		Parry Sound District	Mortality rate of 10% observed in McMurrich Township.
Armyworm *Pseudaletia unipuncta* (Haw.)	Ground cover	Northern and North Central regions	Reported on a variety of hosts in the towns of Kapuskasing, Hearst and Hornepayne and in a number of areas in the Geraldton District.
Ash dieback	Ash	Central Region	Single trees at various locations revealed dieback. Albion Township, Maple District contained a 0.1-ha area severely affected.
Aspen leafblotch miner *Phyllonorycter ontario* (Free.)	Trembling aspen	Northern, North Central and Northeastern regions	Generally low and declining populations through northern Ontario. Severe foliar damage occurred along roadsides and to regeneration in central Geraldton District, eastern Terrace Bay District, and Wawa District.
Aspen webworm *Tetralopha aplastella* (Hulst)	Aspen Birch	Eastern Region	Numerous medium and heavy infestations occurred in trembling aspen stands between Tweed and Campbellford in the Tweed and Napanee districts. Defoliation ranged from 20 to 100% in these areas.
Balsam fir sawfly *Neodiprion abietis* complex	Balsam fir White spruce Black spruce	Northwestern Region	Defoliation of small groups of trees ranged from 50 to 75% within an area of 100 000 ha in Kenora District. Similar damage in a 6 800 ha area in Red Lake District and in a 9 800 ha area in Ignace District.
		Algonquin Region	Heavy defoliation over 500 ha in Pembroke and Algonquin Park Districts.
Bark beetle *Orthotomicus caelatus* (Eichh.)	Red pine	Parry Sound District	High numbers in a 10-ha plantation in McMurrich Township.
Beech scale *Cryptococcus fagisuga* Lind.	Beech	Cambridge District	10% of trees in a 1-ha stand in Dumphries Township were heavily infested.
Birch-aspen leafroller *Epinotia solandriana* (L.)	Birch Poplar	Northern, Northeastern and Algonquin regions	5-ha area sustained 25% defoliation in Nimitz Township, Chapleau District. Common in many other areas at low population levels.
Birch leafminer *Fenusa pusilla* (Lep.)	White birch Grey birch	North Central Region	Populations continued to decline in Thunder Bay and Atikokan Districts but increased substantially in Geraldton and Terrace Bay Districts.
		Northeastern and southern Ontario	Heavy infestations and conspicuous discoloration of foliage throughout.

Ontario Region

Insect or Disease	Host(s)	Location	Remarks
Birch sawfly *Arge pectoralis* (Leach)	Birch	Carleton Place District	Heavy defoliation in 0.5-ha stand in Burgess Township.
		Sudbury District	Moderate-to-severe defoliation in a 1.5-ha stand in McKim Township.
Birch skeletonizer *Bucculatrix canadensisella* Cham.	White birch	Province wide	Overall decline in total area of moderate-to-severe defoliation from 46 700 km² in 1983 to 4 581 km² in 1984.
		Northeastern Region	Largest area of damage totalling 4 035 km² in North Bay and Temagami districts.
		Northern Region	Sizeable pockets of moderate-to-severe defoliation of 518 km² persisted in the Kirkland Lake and Gogama districts.
		North Central Region	Only small scattered pockets of infestation (9 km²) remaining in Thunder Bay and Atikokan districts.
		Algonquin Region	The only areas of significant defoliation, totalling 18 km², occurred in the Algonquin Park District.
Black army cutworm *Actebia fennica* (Tausch.)	Black spruce	Township 239, Hearst District	Appoximately 82 000 recently planted trees destroyed on a 250-ha burned area. Planting was curtailed because of the infestation.
	Jack pine	Miramichi Township Gogama District	5–10% of newly planted trees affected on another prescribed burn site.
	Pine and spruce	Thunder Bay Forest Station	Low levels in several compartments.
Brown-spot needle blight of pines *Scirrhia acicola* (Dearn.) Siggers	Mugho pine	Owen Sound District	The disease affected 50% of the foliage at Inverhuron Provincial Park.
Bruce spanworm *Operophtera bruceata* (Hulst)	Sugar maple	Sault Ste. Marie District	On St. Joseph's Island 4 160 ha suffered defoliation ranging from 30–100%.
		Sudbury District	On Manitoulin Island a 126-ha area was severely defoliated in Allan Township.
Cedar leafminers *Argyresthia thuiella* (Pack.) with *A. canadensis* Free., *A. aureoargentella* Brower, *Pulicalvaria thujaella* (Kft.)	Eastern white cedar	Espanola District	Approximately 3 400 ha of heavy infestation along the south side of Manitoulin Island and on adjacent Kitchener, Cockburn, and Fitzwilliam islands.
		Owen Sound District	Heavy defoliation on approximately 1 400 ha on the west side of the Bruce Peninsula in St. Edmunds, Lindsay and Eastnor townships; light defoliation on 500 ha in the remainder of the district.
		Central Region	Approximately 1 000 ha of light-to-moderate damage in Huronia, Maple, and Cambridge districts.
		Brockville District	Heavy infestations on windbreak trees effectively controlled by two late June and mid-September applications of Cygon 2E at the G. Howard Ferguson Forest Station.

Ontario Region

Insect or Disease	Host(s)	Location	Remarks
Cherry casebearer *Coleophora pruniella* Clem.	Balsam poplar	Espanola District	Severe defoliation of several roadside trees in Bidwell Township.
Eastern blackheaded budworm *Acleris variana* (Fern.)	Hemlock Spruce Balsam fir	Sudbury, Parry Sound, Bracebridge, Minden, and Huronia districts	Populations declined to trace-to-light in 1983 infested areas.
		Geraldton District	Light foliar and cone damage in the Kimberly Clark white spruce seed orchard near Longlac.
Eastern pine shoot borer *Eucosma gloriola* Heinr.	Jack pine Red pine White pine Scots pine	Northern Region	Evaluations in plantations showed leader mortality ranging from 6 to 16%.
		Province-wide	Low numbers reported.
Eastern tent caterpillar *Malacosoma americanum* (F.)	Apple Cherry Hawthorn	Central, Eastern and Algonquin regions; Espanola and North Bay districts	Conspicuous defoliation of roadside shrubs.
Elm casebearer *Coleophora limosipennella* (Dup.)	White birch Trembling aspen	Carleton Place District	A 5-ha area severely defoliated in Gloucester Township.
European alder leafminer *Fenusa dohrnii* (Tisch.)	Alder	Gogama District	Caused heavy defoliation of roadside alder in Mattagami Township.
	European alder	Lindsay District	Severe damage in one compartment at the Orono Forest Station.
European elm scale *Gossyparia spuria* (Mod.)	White elm	Pembroke District	Heavy infestation noted in Bagot Township.
European fruit lecanium *Lecanium corni* Bouché	Red oak	Carleton Place District	Declined to low levels in Lavant Township.
	Honey locust	Simcoe District	Severe shoot damage in Port Dover.
European pine needle midge *Contarinia baeri* (Prell)	Scots pine Red pine	Huronia District	Moderate populations in a 4-ha area in Tiny Township.
		Sault Ste. Marie District	General decline with moderate damage occurring in Vankoughnet, Plummer, and Jocelyn townships.
European pine sawfly *Neodiprion sertifer* (Geoff.)	Red pine Scots pine	Espanola and Huronia districts	Light defoliation in Billings Township. Moderate defoliation in a 12-ha plantation in Mono Township.
		Carleton Place and Brockville districts	Light defoliation at many locations.
European pine shoot moth *Rhyaciona buoliana* (D. & S.)	Red pine	Southern Ontario	Heavy infestations persisted in Osprey Township, Owen Sound District where 87% of 2–4 m trees were attacked. Low populations were reported in Nottawasaga Township, Huronia District, West Nissouri Township, Aylmer District, and Mariposa Township, Lindsay District.
European snout beetle *Phyllobius oblongus* (L.)	White elm Willow	North Bay District	Heavy infestations in Gurd and Bonfield townships.
		Owen Sound and Huronia districts	Low populations noted.

Ontario Region

Insect or Disease	Host(s)	Location	Remarks
Eutypella canker *Eutypella parasitica* Davidson & Lorenz	Sugar maple Red maple	Northeastern, Algonquin, Eastern, Central and Southwestern regions	Surveys showed an incidence of 1–9% in 22 of 29 areas examined.
Fall cankerworm *Alsophila pometaria* (Harr.)	Deciduous species	Central Region	200 ha infested in the Maple District with defoliation ranging from 20 to 100%. Populations declined to low levels in the Cambridge District.
		Northwestern and North Central regions	Moderate-to-severe defoliation occurred in ornamental trees in the towns of Sioux Lookout, Ignace, Dryden, and Fort Frances and in the city of Thunder Bay.
Fall webworm *Hyphantria cunea* (Drury)	Deciduous	Eastern Region	Heavy infestations were reported from a number of locations in the Carleton Place, Tweed and Brockville districts.
		Algonquin Region	Moderate infestations in Burleigh Township, Bancroft District and pockets of heavy defoliation in Gibson Township, Parry Sound District.
		Central Region	Generally moderate damage in the Maple and Huronia districts with small pockets of heavy infestation in Belmont Township, Lindsay District.
		Southwestern Region	Large numbers of nests reported through Aylmer, Simcoe, Chatham, and Wingham districts. Moderate numbers occurred on the Bruce Peninsula, Owen Sound District.
		Northern Ontario	Heavy infestation on 5 ha in Beaucage Township, North Bay District; common at several points in the Temagami, Kirkland Lake, and Timmins districts; small population increases were noted in Thunder Bay and Atikokan districts.
Fir coneworm *Dioryctria abietivorella* (Grt.)	White pine	Southwestern Region	Light infestations occurred in plantations in Hullet and Turnberry townships, Wingham District and West Oxford Township, Aylmer District.
Fire blight *Erwinia amylovora* (Burr.) Winsl. et al.	Ornamental Mountain ash	Kapuskasing and Cochrane districts	Moderate-to-severe infections were observed in the towns of Kapuskasing and Cochrane.
Fireweed rust *Pucciniastrum epilobii* Otth.	Balsam fir	Chapleau District	Light defoliation reported in Gallagher and Daoust townships.
Fomes root rot *Heterobasidion annosum* (Fr.) Brec.	Red pine	Eastern Region	Two new infection centres in the Larose Forest, Cornwall District and one in the Limerick Forest, Brockville District.
Frost damage	Trembling aspen and coniferous species	Northwestern Region and Atikokan District	Widespread areas of severe damage were observed.
		Sault Ste. Marie and Blind River districts	Seriously affected trees were confined mainly to the southern part of both districts.
		Central Region	A high incidence of affected trees with very light damage was reported.
Greenstriped mapleworm *Dryocampa rubicunda* *rubicunda* (F.)	Maple	Northeastern Region	A single heavy infestation continued on 202 ha in Selby Township, Temagami District. Elsewhere in the Region populations declined.

Ontario Region

Insect or Disease	Host(s)	Location	Remarks
Hail and wind damage	Coniferous and deciduous species	Fort Frances District	High winds accompanied by hail caused extensive damage to 3 981 ha and affected 385 060 m^3 of wood.
Hypoxylon canker *Hypoxylon mammatum* (Wahl.) J.H. Miller	Trembling aspen	Northern, North Central and Northwestern regions	Special surveys revealed an incidence of stem infections of 1–9% in 30 of 49 areas surveyed.
Ice storm damage	Red pine	Tweed District	Damage in the form of broken or uprooted trees was recorded in some plantations.
Imported willow leaf beetle *Plagiodera versicolora* (Laich.)	Willow	Eastern Region	Heavy infestations occurred on several willow clones at the G. Howard Ferguson Forest Station, Brockville District.
Ink spot of aspen *Ciborinia whetzelii* (Seaver) Seaver	Trembling aspen	Northern Region	Small, sporadic pockets of less than 10 ha with foliar damage ranging from 30–80% were observed at widely scattered locations; areas of light damage commonly found.
		Eastern, Algonquin and Northeastern regions	Damage levels of 1–10% were recorded.
Introduced pine sawfly *Diprion similis* (Htg.)	Pine	Northwestern Region	Medium-to-heavy infestation persisted in the area of Lake of the Woods, Kenora District.
Jack pine resin midge *Cecidomyia resinicola* (O.S.)	Jack pine	Carleton Place	5% of the shoots were destroyed on 12% of trees in a 2-ha stand in Marlborough Township.
Jack pine sawflies *Neodiprion pratti banksianae* Roh.	Jack pine	Pembroke District	Defoliation up to 100% in 19 ha of plantations in North Algona, Wilberforce and Hagarty townships. Light damage noted in Radcliffe and Alice townships.
Neodiprion pratti paradoxicus Ross	Jack pine	Northern Region, Cornwall and Brockville districts	Scattered colonies recorded. Moderate-to-severe defoliation in plantations in Elizabethtown, Lochiel, and Plantagenet Townships.
Jack pine tip beetle *Conophthorus banksianae* McP.	Jack pine	Northern and Northeastern regions	Low populations common in plantations through much of the area.
Larch casebearer *Coleophora laricella* (Hbn.)	Tamarack European larch	Northeastern Region	Small pockets of moderate-to-severe defoliation on tamarack in Sudbury and Espanola districts.
		Algonquin Region	Moderate-to-severe defoliation was noted in numerous 1 to 5-ha tamarack stands in Bancroft and Parry Sound districts; lower populations occurred in Pembroke, Algonquin Park and Bracebridge districts.
		Central Region	A total of approximately 120 ha of tamarack sustained moderate damage and 20 ha of European larch suffered heavy damage in the Huronia and Maple districts respectively.
		Eastern Region	Moderate-to-severe defoliation was evident in 0.5 to 20-ha stands in the Carleton Place, Brockville, and Cornwall districts.

Ontario Region

Insect or Disease	Host(s)	Location	Remarks
Larch needle cast *Meria laricis* Vuill.	European larch	Southwestern Region	The disease was collected at two new locations in Glenelg Township, Owen Sound District. Little damage occurred at points where this disease was first found in 1983.
Larch-poplar rust *Melampsora medusae* Thuem.	Hybrid poplars	Brockville District	Heavy infections recorded at the G. Howard Ferguson Forest Station.
Larch sawfly *Pristiphora erichsonii* (Htg.)	Tamarack	North Central Region	Pockets of moderate-to-severe defoliation in Errington and Oakes townships, Geraldton District, in McTavish, Neebing, Joynt, Upsala and Pyramid townships, Thunder Bay District and near Banning Lake Road, Atikokan District.
Large aspen tortrix *Choristoneura conflictana* (Wlk.)	Trembling aspen	Northeastern Region	A total of approximately 4 400 ha of moderate-to-severe defoliation occurred in Espanola District.
Larger boxelder leafroller *Archips negundana* (Dyar)	Manitoba maple	Sudbury District	Severe defoliation of trees in city of Sudbury.
Leaf beetle *Pyrrhalta* sp. (probably *decora*)	Trembling aspen	Sioux Lookout District	Heavy defoliation within a 65-km² area in Drayton Township.
Leaf blight *Linospora tetraspora* G.E. Thomp.	Balsam poplar	Cochrane, Pembroke, Algonquin Park and Bancroft districts	Severe foliage infections of regeneration were observed throughout.
Leaf blight *Septoria betulina* Pass.	White birch Yellow birch	Thunder Bay, Nipigon, Sault Ste. Marie, Wawa, Terrace Bay districts North Bay District	Browning of foliage and premature leaf fall were common in numerous stands. Moderate damage involving up to 40% of the foliage in a 10-ha area near McConnell Lake, Clarkson Township.
Leaf-blister rust *Taphrina caerulescens* (Mont. & Dsm.) Tul.	Red oak	Sudbury District	Moderate-to-severe damage recorded in Killarney and Fairbanks Provincial Parks.
Leaf spot *Marssonina brunnea* (Ell. & Ev.) Sacc.	Poplars	Pembroke and Lindsay districts	High incidence of damage in Sherwood Township and at the Orono Forest Station.
Leaf spot *Marssonina juglandis* (Lib.) Magn.	Butternut Black walnut	Central, Eastern and Algonquin regions Chatham and Simcoe districts	Medium-to-heavy infections caused severe browning and early leaf drop. Light foliar damage was reported.
Leaf spot *Mycosphaerella populicola* G.E. Thomp.	Balsam poplar	Eastern, Algonquin, Central, Northeastern and Northern regions	Increased heavy foliar infections caused leaf discoloration and premature leaf drop.
Leaf spot *Septoria populicola* Pk.	Balsam poplar	Cochrane and Pembroke districts	Brown foliage and premature leaf drop were typical symptoms.
Linden looper *Erannis tiliaria tiliaria* (Harr.)	Deciduous species	Sault Ste. Marie District	High populations in city and environs.

Ontario Region

Insect or Disease	Host(s)	Location	Remarks
Maple leafblotch miner *Cameraria aceriella* (Clem.)	Maple	Algonquin and Eastern regions	High populations were observed throughout a 25-ha woodlot in Lutterworth Township, Minden District; low populations were reported from several areas in the Tweed, Carleton Place, and Brockville districts.
Maple leafcutter *Paraclemensia acerifoliella* (Fitch)	Maple	Northeastern Region	Light infestations were reported from Campemont D'ours and St. Joseph Islands, Sault Ste. Marie District.
		Algonquin Region	Heavy defoliation covering 126 ha in Wilberforce Township, Pembroke District, and 126 ha in Limerick Township, Bancroft District. Moderate damage in 920-ha stand in Harvey Township, and in a 15-ha area in Dysort Township, Minden District.
		Central Region	Surveys in Belmont Township in Lindsay District revealed a heavy infestation covering 3-ha area. Moderate-to-heavy damage covering 36 ha occurred in the Huronia and Cambridge districts.
		Eastern Region	Severe damage totalling 572 ha in Tweed District, 10 ha in Carleton Place District and 6 ha in Oxford Township, Brockville District.
Maple trumpet skeletonizer *Epinotia aceriella* (Clem.)	Maple	Algonquin and Northeastern regions	Area of moderate-to-severe defoliation was reduced from 135 000 ha in 1983 to approximately 24 750 ha not including another infested area of about 6 000 ha on St. Joseph Island, Sault Ste. Marie District.
		Eastern Region	Heavy small infestations (0.5 — 20 ha) were reported from a number of locations in Tweed and Napanee districts.
		Southern Ontario	Generally light infestations.
Maple webworm *Tetralopha asperatella* (Clem.)	Maple	Eastern Region	Numerous light and medium infestations.
		Algonquin Region	Trace to light numbers in most sugar maple stands examined.
Mountain-ash sawfly *Pristiphora geniculata* (Htg.)	Mountain ash	North Central and Northern regions, Sault Ste. Marie and Wawa districts	High populations continued to cause severe defoliation of ornamentals and trees along roads and highways.
Mouse damage	Jack pine	Napanee District	A 4-ha stand in Percy Township experienced 5% mortality.
Needle cast *Davisomycella ampla* (Davis) Darker	Jack pine	Sioux Lookout and Pembroke districts	Medium infections were encountered in Buchanan Township, Pembroke District and Lomond Township, Sioux Lookout District.
		Northern Ontario	Mainly areas of light defoliation were recorded.
Needle cast *Lophodermium seditiosum* Minter et al.	Red pine	North Bay and Chapleau districts	Heavy foliar damage in two areas.

Ontario Region

Insect or Disease	Host(s)	Location	Remarks
Needle cast *Rhabdocline pseudotsugae* Syd. subsp. *pseudotsugae*	Douglas-fir	Central Region	One hundred percent of trees infested with an average of 18% foliar damage in a 40-ha Christmas tree plantation, Clarke Township, Lindsay District.
Needle cast *Rhizosphaera kalkhoffii* Bubak	Blue spruce White spruce	Owen Sound District	Heavy infections persisted in one plantation in Glenelg Township.
Needle droop	Jack pine	Chapleau District	A 4-ha area of young jack pine had 9% of the trees affected in Nimitz Township.
Northern pine weevil *Pissodes approximatus* Hopk.	Red pine	Parry Sound and Espanola districts	High numbers in McMurrich Township. Light damage in a 1-ha plantation in Salter Township.
Oak leaf shredder *Croesia semipurpurana* (Kft.)	Red oak	Central Region	Populations continue to decline. Light defoliation occurred within 50 ha in Uxbridge Township, Maple District.
		Northeastern	A total of 10 ha of moderate and 25 ha of light damage occurred in the Blind River and Sault Ste. Marie districts.
		Southern Ontario	Very low populations recorded at numerous points.
Oak olethreutid leafroller *Pseudexentera cressoniana* (Clem.)	Red oak	Parry Sound District	Low numbers along highway 559 in Harrison and Carling townships.
Oak sawfly *Arge scapularis* Klug	Red oak Rock elm	Brockville District	Heavy defoliation in a 0.5-ha stand in Charleston Lake Provincial Park.
Oak skeletonizer *Bucculatrix ainsliella* Murt.	Oak	Southern Ontario	Populations reduced to low numbers in most areas of past moderate-to-severe defoliation in 1983. Small areas of medium infestation persisted in the Cambridge District.
Pine bark adelgid *Pineus strobi* (Htg.)	White pine	Simcoe District	Light damage in a 2-ha stand in South Walsingham Township and high numbers in thinned trees at St. Williams Nursery.
		Lindsay District	Approximately 60% of trees in a 2-ha plantation at the Orono Forest Station were infested.
Pine false webworm *Acantholyda erythrocephala* (L.)	Pine	Central Region	Generally light damage in a number of plantations. Ninety-seven percent of trees affected in Balsam Lake Provincial Park, Lindsay District.
		Algonquin Region	Defoliation of 75–90% of old needles was recorded in Wicklow Township, Bancroft District; a white pine seed orchard was successfully sprayed with Sevin-4-oil in Snowden Township, Minden District.
		Eastern Region	Several areas of heavy defoliation in Marlborough and Oxford on Rideau townships in the Carleton Place and Brockville districts respectively.

Ontario Region

Insect or Disease	Host(s)	Location	Remarks
Pine needle rust *Coleosporium asterum* (Diet.) Syd.	Jack pine Red pine	Hearst District	Heavy foliar infections recorded for 4th consecutive year in Arnott Township.
		Maple District	Moderate infections observed in Uxbridge Township.
Pine needle sheathminer *Zelleria haimbachi* Bsk.	Pine	Northeastern Region	Open-grown semimature jack pine in Windy Lake Provincial Park were again heavily attacked, as were mature jack pine in Lorne, Hess, and Cartier townships, Sudbury District. High populations were recorded in many stands in the Temagami District. Low populations reported from several areas in Sault Ste. Marie and Blind River districts.
		Northern Region	High numbers of larvae in small jack pine stands in the Kirkland Lake District.
		Algonquin Region	High numbers of larvae found in Wallbridge, Harrison, Shawanaga, Carling, and McDougall townships, Parry Sound District.
		Maple District	Forty-five percent foliar damage occurred over a 2-ha area in Durham Regional Forest, Uxbridge Township.
Pine root collar weevil *Hylobius radicis* Buch.	Red pine Scots pine	Huronia District	Fifty-four percent of 8-m trees damaged in Brentwood tract in Sunnidale Township; damage noted at several points in Oro Township.
		Pembroke District	Damaged trees in 4-ha plantation in Richards Township.
Pine spittlebug *Aphrophora cribrata* (Wlk.)	Conifers	Eastern Region	High population in a 0.5-ha white pine stand in East Hawkesbury Township, Cornwall District; moderate infestation on Scots pine in Oxford on Rideau Township, Brockville District.
		Central Region	Medium infestations on Scots pine in Oro Township, Huronia District, Beverley Township, Cambridge District and Uxbridge Township, Maple District; similar levels on white pine in Bexley Township, Lindsay District.
		Algonquin, Southeastern, and Northeastern regions	Numerous reports of low populations in the Algonquin and Southeastern regions and in Wawa District of the Northeastern Region.
Poplar flea beetle *Altica populi* Brown	Balsam poplar	Algonquin Region Espanola District	Heavy infestations at many points.
Red band disease *Scirrhia pini* Funk & Parker	Austrian pine	Huronia District	New light infection reported in Awenda Provincial Park.
Redheaded jack pine sawfly *Neodiprion virginianus* complex	Jack pine	Northern Region	Colonies collected in Studholme and Fushimi townships, Hearst District and in Gilliland, Peters and Kaplan Townships, Chapleau District.

Ontario Region

Insect or Disease	Host(s)	Location	Remarks
Redheaded pine sawfly *Neodiprion lecontei* (Fitch)	Red pine Jack pine	Brockville District	Two plantations totalling 8 ha were sprayed with malathion; increasing numbers noted through this district.
		Espanola District	In Campbell Township, nine plantations sprayed with polyhedral virus.
Redhumped caterpillar *Schizura concinna* (J.E. Smith)	Apple Burr oak White elm	Northwestern Region	Defoliation ranged from 15 to 60% on apple, burr oak, and white elm at sporadic locations in southern Kenora District and western Fort Frances District.
Red pine cone beetle *Conophthorus resinosae* Hopk.	Red pine	Northeastern Region	Conspicuous shoot damage to trees in shoreline stands on islands in Lake Temagami, Temagami District.
Red pine sawfly *Neodiprion nanulus nanulus* Schedl.	Red pine Jack pine	Northwestern Region North Central Region	In Ignace District fringe and understory trees were 75 to 100% defoliated over 55 000 ha. In Dryden District similar defoliation in 8 700 ha. Moderate-to-severe defoliation in Shebandowan-Shabaqua area.
		Northern and Northeastern Regions	Pockets of moderate-to-severe defoliation.
Salt damage	White pine Red pine White spruce	Southwestern, Eastern and Central districts	Trees along major highways were adversely affected.
Saratoga spittlebug *Aphrophora saratogensis* (Fitch)	Pine	Pembroke District	New area of medium infestation with 53% of trees affected and 18% foliar damage in Fraser Township; patches of mortality have occurred in a previously infested area in Hagarty Township.
Satin moth *Leucoma salicis* (L.)	Silver poplar	Brockville and Cornwall districts	Small, new infestations near the town of Brockville and Winchester.
Sawyer beetles *Monochamus* spp.	Jack pine	Kirkland Lake District	Two ha of jack pine killed in McCann Township along edge of recently harvested stand.
Septoria canker *Septoria musiva* Pk.	Trembling aspen Balsam poplar	Bancroft and Hearst districts	Severe damage to regeneration was recorded.
	Trembling aspen	Algonquin Region	Widespread leaf infections with severe damage levels in Chandos Township, Bancroft District.
Shoot blight *Sirococcus strobilinus* Preuss	Red pine	Atikokan District	Common at French Lake Ranger Station.
Shoot blight *Venturia macularis* (Fr.) E. Müll. & Arx	Trembling aspen	Northern Region	Suveys revealed an average terminal shoot mortality of 31% in 14 areas.
		Huronia, Wawa, Thunder Bay, Atikokan and Nipigon districts	Moderate-to-severe infections.
Shorthorned oakworm *Anisota finlaysoni* Riotte	White oak Burr oak	Cambridge District	Twenty to one hundred percent defoliation on roadside trees in the town of Milton and in Blenheim Township.
Slug sawfly *Caliroa* sp.	Red oak	Huronia District Maple District	Twenty percent defoliation of small groups of trees recorded at several locations.

Ontario Region

Insect or Disease	Host(s)	Location	Remarks
Small birch leafminer *Ectoedemia lindquisti* (Free.)	White birch	Huronia Region	Heavy infestations occurred on Beausoleil Island and in Tiny Township.
Spearmarked black moth *Rheumaptera hastata* (L.)	White birch Black cherry	Chapleau District	Declined sharply in 1984 to trace-to light defoliation.
Spruce bud moth *Zeiraphera canadensis* Mut. & Free.	White spruce	Simcoe, Aylmer, Chatham and Wingham districts	Trace-to-low bud damage.
Spruce cone rust *Chrysomyxa pirolata* Wint.	Spruce	Hearst, Thunder Bay, Maple and Blind River districts	Plantations, seed orchards and seed production areas experienced cone infections ranging from 3 to 37%.
		Nipigon, Atikokan, Bracebridge and Cochrane districts	Small numbers of diseased cones were collected.
Spruce needle rusts *Chrysomyxa ledi* (Alb. & Schw.) de By. and *C. ledicola* Lagerh.	Spruce	North Central, Northwestern and Northern regions	Foliar damage was widespread with infection levels of up to 100% and corresponding foliar damage ranging from 1 to 100%.
		Cornwall and Pembroke districts	Light damage noted in two areas.
Spruce spider mite *Oligonychus ununguis* (Jac.)	Tamarack	Kapuskasing and Hearst districts	Severe browning of foliage in Fauquier Township and in Casgrain Township. Up to 50% of the foliage affected.
Swaine jack pine sawfly *Neodiprion swainei* Midd.	Jack pine	Temagami and Kirkland Lake districts	Declined to low numbers in the Elk Lake management unit.
Sweetfern blister rust *Cronartium comptoniae* Arth.	Jack pine	Northern Region	Infection levels of 28% and 24% were recorded in Calvert and Neelands Townships; varying damage levels observed elsewhere in the Region.
Swiss needle cast *Phaeocryptopus gaeumannii* (Rohde) Petr.	Douglas-fir	Huronia District	A 6-ha Christmas tree plantation in Tiny Township had 29% of the trees affected and averaged 40% foliar damage.
Tip blight *Sphaeropsis sapinea* (Fr.) Dyko & Sutt.	Scots pine Jack pine Red pine Austrian pine	Central Region and Cornwall District	Heavy needle infections in plantations and on roadside trees.
		Brockville and Pembroke districts	Light damage recorded.
Twig blight *Cenangium ferruginosum* Fr.	Scots pine	Huronia District	Heavy infections were responsible for branch and top mortality in Adjala Township.

Ontario Region

Insect or Disease	Host(s)	Location	Remarks
Two leaftier *Psilocorsis reflexella* Clem.	Red oak White birch Trembling aspen Sugar maple White oak	Huronia District	Severe defoliation (40% on white oak, 20% on red oak) on Beausoleil Island, in Georgian Bay Islands National Park and at Six Mile Lake Provincial Park.
		Bracebridge District	Severe foliage discoloration and foliar damage of 50–75% noted in Muskoka Lakes area.
		Minden District	Conspicuous damage at many points.
		North Bay District	Moderate numbers in 2-ha area in Patterson Township.
		Sudbury and Chatham districts	Light populations were recorded.
Walnut caterpillar *Datana integerrima* G. & R.	Walnut Hickory Butternut	Southern Ontario	Moderate defoliation to small groups of trees in Seymour Township, Napanee District; Clarence Township, Cornwall District; and on roadside trees in the city of Brampton, Maple District.
Western gall rust *Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka	Jack pine	Ignace and Chapleau districts	Stem cankers were found on 12.4% and 10% of the trees examined in the districts of Ignace and Chapleau, respectively.
		North Central, Algonquin, Northeastern and Central regions	Branch damage was less than 5%.
White pine blister rust *Cronartium ribicola* J.C. Fisch.	White pine	Cochrane, Pembroke and Brockville districts	Moderate-to-severe stem infections; 4% mortality in two areas.
		Bracebridge, Sault Ste. Marie, Wawa and Maple districts	Light damage of 1–6% recorded in these areas.
White pine cone beetle *Conophthorus coniperda* (Schw.)	White pine	Algonquin Region	Light shoot damage on some islands in Georgian Bay and in Conger and Gibson townships, Parry Sound District.
		Southwestern Region	Low number of damaged cones, Charlotteville Township, Simcoe District.
White pine weevil *Pissodes strobi* (Peck)	White pine Jack pine Mugho pine Red pine Black spruce White spruce	Province wide	Populations were relatively low in northern Ontario except in the Northeastern Region where leader mortality reached 55%. In southern Ontario counts of 38–43% leader mortality in the Algonquin Region and as high as 56% in Owen Sound District of the Central Region.
Willow leafminer *Micruapteryx salicifoliella* (Cham.)	Willow	Northern and Northwestern regions	Conspicuous foliage browning at many points in Hearst, Geraldton, Nipigon and Terrace Bay districts.
Wind damage	Jack pine Deciduous species	Central and Algonquin regions	High winds and a tornado caused scattered blowdown of trees.

Ontario Region

Insect or Disease	Host(s)	Location	Remarks
Winter drying	White pine Norway spruce White spruce White cedar Red pine	Central, Eastern Algonquin and Southwestern regions	Windbreaks, forest fringe trees, plantations and roadside trees were seriously affected.
		Espanola District	Light mortality of 1.3% was detected in Merritt township.
Yellowheaded spruce sawfly *Pikonema alaskensis* (Roh.)	White spruce Black spruce	Northern Region	Pockets of heavy damage in plantations in Timmins and Cochrane districts.
		Northwestern Region	High populations persisted in Ignace and Sioux Lookout districts.
Yellow witches-broom *Melampsorella caryophyllacearum* Schroet.	Balsam fir	Hearst and Cochrane districts	Light infections noted in Greenwater and Fushimi Provincial Parks.

Other Insects and Diseases

Western and Northern Region

Insect or Disease	Host(s)	Location	Remarks
Armillaria root rot *Armillaria mellea* (Vahl ex Fr.) Kumm.	Pine	Prairie provinces	Low but significant tree mortality in natural regeneration and plantations. In Manitoba, extensive tree mortality in red pine plantations.
Bark beetle *Hylurgops rugipennis* Mann.	Jack pine	Northwest Territories Alberta	Found associated with other organisms in small patches of recently killed jack pine in Northwest Territories.
Birch leafminers *Fenusa pusilla* (Lep.) *Heterarthrus nemoratus* (Fall.) *Profenusa thomsoni* (Konow)	Birch species	Prairie provinces	Continued to cause moderate-to-severe leaf injury in urban areas, and increased damage in some forested areas caused mostly by *P. thomsoni*, especially in northern Manitoba.
Bruce spanworm *Operophtera bruceata* (Hulst)	Aspen	Saskatchewan Alberta Northwest Territories	Light infestations in a few areas.
Chemical injury	Several species	Prairie provinces	A slight increase in reports of mortality and injury to nontarget trees by chemicals, especially soil sterilants in urban areas.
Comandra blister rust *Cronartium comandrae* Pk.	Pine	Prairie provinces Northwest Territories	Low level of infections in pine regeneration areas. Widely distributed on jack pine in the Northwest Territories.
Cytospora canker *Cytospora chrysosperma* Pers. ex Fr.	Poplars	Alberta Saskatchewan	Common on native trees and hybrid poplar shelterbelts in several areas.
Drought injury	Many species	Alberta Saskatchewan	Common north of a line extending from North Battleford east to Hudson Bay, Sask., and in Lethbridge-Medicine Hat area.
Eastern blackheaded budworm *Acleris variana* (Fern.)	Spruce	Prairie provinces	Common in Yoho, Jasper, and north end of Banff National Parks causing light damage. Very light defoliation in central Saskatchewan.
European spruce sawfly *Gilpinia hercyniae* (Htg.)	Spruce	Manitoba	Low populations in southeastern Manitoba with little spread beyond its western boundary near Winnipeg. Collected from white spruce in the Hadashville Provincial Tree Nursery.
Fall cankerworm *Alsophila pometaria* (Harr.)	Manitoba maple White elm Green ash	Prairie Provinces	Extensive patches of moderate-to-severe defoliation common in southern Manitoba, central Saskatchewan. Low population levels reported in southern Alberta.
Fire blight *Erwinia amylovora* (Burr.) Winslow et al.	Apple Cotoneaster Crabapple Hawthorn Mountain-ash	Major urban centers	A noticeable decrease of infections in Saskatchewan and Alberta.
Frost damage	Many species	Prairie provinces Northwest Territories	Frost injury was common in several areas, especially on spruce and hybrid poplars in southwestern Saskatchewan and western Manitoba.
Hypoxylon canker *Hypoxylon mammatum* (Wahl.) J.H. Miller	Aspen	Prairie provinces	Light-to-moderate infection common throughout host range.
Introduced pine sawfly *Diprion similis* (Htg.)	Scots pine	Manitoba	First detected in 1983, the distribution has remained unchanged.

Western and Northern Region

Insect or Disease	Host(s)	Location	Remarks
Larch casebearer *Coleophora laricella* (Hbn.)	Larch	Manitoba	Moderate-to-severe defoliation occurred in three areas of Manitoba.
Large aspen tortrix *Choristoneura conflictana* (Wlk.)	Aspen	Alberta Saskatchewan	Continuance of light, moderate and severe damage in the Cypress Hills, Sask. and Alberta, and southern Alberta.
Lodgepole terminal weevil *Pissodes terminalis* Hopping	Pine	Prairie provinces	Infestations are common on young trees throughout the provinces. One plantation in Manitoba had 85% (cumulative over several years) of jack pine trees with top kill.
Mountain-ash sawfly *Pristiphora geniculata* (Htg.)	Mountain-ash	Manitoba	First record of occurrence in Manitoba was light infestation on one tree at Falcon Lake.
Northern pitch twig moth *Petrova albicapitana* (Bsk.) *P. metallica* (Bsk.)	Jack pine Lodgepole pine	Prairie provinces Northwest Territories	Primarily *P. albicapitana* caused numerous top and branch kill on young pine trees.
Pear sawfly *Caliroa cerasi* (L.)	Mountain-ash Cotoneaster Apple Plum	Alberta Saskatchewan	Remains a persistent and sometimes serious leaf skeletonizer of many urban plants.
Pine engraver *Ips pini* (Say)	Jack pine Lodgepole pine	Prairie provinces Northwest Territories	Light infestations in weakened trees throughout the region.
Pine needle cast *Lophodermella concolor* (Dearn.) Darker	Lodgepole pine	Alberta	Continues to be responsible for considerable needle loss on urban plantings and shelterbelts in central Alberta. Infection levels remained low in most forested areas.
Pine root collar weevil *Hylobius radicis* Buch.	Pine	Southeast Manitoba	Occurs in low numbers in pine plantations.
Pine wood nematode *Bursaphelenchus xylophilus* (Steiner and Buhrer) Nickle	Jack pine	Manitoba	First identified from 2 dead jack pines in 1982, the nematode was again identified in 1984 in dying or dead trees attacked by *Monochamus* spp. in two stands in the Belair Provincial Forest.
Rabbit damage	Lodgepole pine Jack pine Spruce	Prairie provinces	Light tree mortality near Pine Lake, Wood Buffalo National Park. Very light throughout the provinces.
Red belt injury	Pine Fir	Northwest Territories	Moderate-tc-severe foliage injury to pine and fir on the east slope of Mackenzie Mts., N.W.T.
Sawyer beetles, mainly *Monochamus scutellatus* (Say)	Lodgepole pine Jack pine White spruce Black spruce	Region-wide	Adult feeding in northwestern Manitoba around jack pine clearcuts; variable wormhole damage in fire-killed timber.
Scleroderris canker *Gremmeniella abietina* (Lagerb.) Morelet	Lodgepole pine	Alberta	Found only in known areas of Jasper National Park.
Silver leaf *Stereum purpureum* (Pers. ex Fr.) Fr. (= *Chondrostereum p.*)	Mountain-ash Apple Cotoneaster Other species	Prairie provinces	Continued to be a common problem in urban areas and on older farmsteads.

Western and Northern Region

Insect or Disease	Host(s)	Location	Remarks
Spruce gall aphids *Adelges cooleyi* (Gill.) *Pineus similis* (Gill.) *Pineus pinifoliae* (Fitch)	Spruce Pine	Prairie provinces Northwest Territories	Damage light but common in several areas. Aphids on pine increased in urban areas.
Spruce spider mite *Oligonychus ununguis* (Jac.)	Spruce Juniper Cedar	Prairie provinces	Continued as the most reported spruce pest in urban areas and is a perennial problem.
Two-year-cycle spruce budworm *Choristoneura biennis* Free.	Alpine fir Englemann spruce	British Columbia	Light damage in northern Kootenay National Park.
Western gall rust *Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka	Lodgepole pine Jack pine	Prairie provinces	Common at low levels in most young pine regeneration, plantations, and on some urban trees.
White pine weevil *Pissodes strobi* (Peck)	Spruce Pine	Prairie provinces	Infested dead tops were common on young trees throughout the region. Top-kill also occurred on pines and spruces in several provincial nurseries and plantations.
Willow leaf miner *Lyonetia* sp.	Willow	Prairie provinces Northwest Territories	Patches of moderate-to-severe damage common in northern Manitoba. Moderate-to-severe in many scattered areas in central Saskatchewan and light in Alberta. Moderate-to-severe leafmining near Fort Liard, Northwest Territories.
Winter drying	Several species	Prairie provinces	Light-to-severe damage occurred sporadically on several conifers. Reddening of balsam fir and jack pine was fairly extensive east of Lake Winnipeg.
Yellow headed spruce sawfly *Pikonema alaskensis* (Roh.)	Spruce	Prairie provinces Northwest Territories	Generally, light injury throughout the region. Moderate-to-severe injury in shelterbelts and in urban areas in Saskatchewan and Alberta. Moderate-to-severe defoliation of scattered white spruce reproduction in central Manitoba.

Other Insects and Diseases

Pacific and Yukon Region

Insect or Disease	Host(s)	Location	Remarks
Armillaria root rot *Armillaria ostoyae (=mellea)* [Romagn.] Herink	Douglas-fir Lodgepole pine	Throughout British Columbia	Widespread individual tree and pockets of mortality.
Balsam woolly adelgid *Adelges piceae* (Ratz.)	Alpine fir Amabilis fir Grand fir	Southwestern, coastal British Columbia	No significant change of infestation zone. Observations in the Nelson Region, north of the recent discovery in Idaho, were negative.
Birch leafminer *Lyonetia saliciella* Busck	White birch	Nelson and Prince George regions	Populations declined, foliar browning common but generally light. Valemount, Mt. Robson and Golden areas.
Black army cutworm *Actebia fennica* (Tausch.)	Lodgepole pine White spruce	Cariboo, Prince George, Prince Rupert, and Kamloops regions	Light to severely defoliated conifer seedlings and herbaceous growth in 6 of 27 recently burned sites, a decline from 1983. Some planting schedules were altered. Populations are expected to continue at generally low levels in 1985. Parasitism and a nuclear polyhedrosis virus were common.
Cypress tip moth *Argyresthia* sp.	Cypress	Vancouver Island	Severe discoloration, with branch tip and tree mortality of ornamental trees and shrubs for the second consecutive year.
Larch budmoth *Zeiraphera improbana* (Wlk.)	Western larch	Nelson Region	Outbreaks declined significantly to 1 100 ha in 10 areas compared to 6 000 ha in 36 areas in 1983.
Larch casebearer *Coleophora laricella* (Hbn.)	Western larch	Nelson and Kamloops regions	Light-to-moderate defoliation covered 41 000 ha down from 60 000 ha in 1983 from Elko north to Kimberley and west to Kootenay Lake. Increased populations expected in 1985. Two releases of parasites were made.
Larch needle blight and needle cast *Meria laricis* Vuill. *Hypodermella laricis* Tub.	Western larch	Southeastern British Columbia Southern Vancouver Island	Infections were more severe and extensive than in 1983 after a wetter than normal spring. *M. laricis*, collected for the first time on Douglas-fir, lightly infected four seed orchards and one natural stand on Vancouver Island.
Larch sawfly *Pristiphora erichsonii* (Htg.)	Western larch Tamarack	Nelson Region and Yukon Territory	Defoliation, mostly light, declined in area by a third to 3 000 ha in 20 stands. Pockets of defoliated tamarack occurred north of Watson Lake; the first since 1954.
Phellinus root rot *Phellinus weirii* (Murr.) Gilbertson	Douglas-fir	All regions	Continues to be common in coastal and interior stands.
Pine engraver beetle *Ips pini* (Say)	Lodgepole pine	Cariboo and Prince Rupert regions	Increased current attacks in thinning slash and recently windthrown mature trees; could build up and attack adjacent standing trees.
Pine needle casts *Lophodermella concolor* (Dearn.) Darker, and *L. montivaga* Petr.	Lodgepole pine	All regions	Conspicuous and severe discoloration of 1983 foliage was common, especially in the central interior, including for the second consecutive year, trees in the Red Rock provenance trial south of Prince George.
Pine sawfly *Neodiprion* spp.	Shore pine	Queen Charlotte Islands	Severe defoliation over 200 ha for the second consecutive year.
Pine wood nematode *Bursaphelenchus xylophilus* (Steiner and Buhrer) Nickle	Pines	All regions negative	Surveys including 25 wood samples and several cerambycid adults to determine the presence of this wilt disease were negative. Some native nematodes were isolated.

Pacific and Yukon Region

Insect or Disease	Host(s)	Location	Remarks
Polyporus root rot *Polyporus tomentosus* Fr. Sartory & Maire	White spruce Sitka spruce	Prince George and Prince Rupert regions	Infection of mature spruce trees in 28 surveyed stands varied greatly and averaged 35%.
Red band needle blight *Scirrhia pini* Funk & Parker	Western white pine Lodgepole pine	Nelson Region	Infection increased and was widespread for a third consecutive year.
Rodent damage (voles and porcupine)	Lodgepole pine Western hemlock Sitka spruce	Nelson, Prince Rupert, Kamloops and Vancouver regions	Tree mortality, top kill, and severe debarking of trees was widespread and increased.
Satin moth *Leucoma salicis* (L.)	Trembling aspen Black cottonwood	Nelson and Kamloops regions	Caused moderate-to-severe defoliation for the second consecutive year in widely scattered pockets.
Shoot blights *Venturia macularis* (Fr.) E. Müll. & Arx *V. populina* (Vuill.) Fabric.	Trembling aspen Black cottonwood	Prince George, Prince Rupert, Nelson and Kamloops regions	Moist spring weather favored infection resulting in widespread moderate-to-severe defoliation and dieback.
Spruce aphid *Elatobium abietinum* (Wlk.)	Sitka spruce	Queen Charlotte Islands and coastal areas of Prince Rubert Region	Scattered mortality and moderate-to-severe defoliation of immature and mature Sitka spruce for the second consecutive year.
Spruce engraver beetle, A *Ips perturbatus* (Eichh.)	White spruce	Prince George Region	Normally in slash or tops, this beetle top-killed more than 3 000 mature white spruce adjacent to spruce beetle-infested stands in the McGregor and Torpy river drainages.
Striped alder sawfly *Hemichroa crocea* (Geoff.)	Red alder	Prince Rupert Region	Increased populations caused mostly light with some severe defoliation for the second consecutive year.
Terminal crook disease *Colletotrichum acutatum* Simmonds	Western hemlock	Vancouver Island	A fourth survey of previously infested outplanted stock was still negative.
Tip blight *Delphinella* spp.	Alpine fir	Prince George Region	Increased infection killed up to 80% of the current year's buds and severely discolored the 1984 needles on trees of all age classes north of Prince George to McLeod Lake.
Western balsam bark beetle *Dryocoetes confusus* Swaine	Alpine fir	Cariboo, Kamloops, Nelson, Prince George, and Prince Rupert regions	Mortality continues in chronically infested stands. Increased aerial coverage mapped more than 35 000 ha affected, mostly in the Bulkley and Morice drainages.
Western false hemlock looper *Nepytia freemani* Mun.	Douglas-fir	Kamloops and Nelson regions	Infestations collapsed after three years, largely because of naturally occurring viruses.
Western hemlock looper *Lambdina fiscellaria lugubrosa* (Hulst)	Western hemlock Western red cedar	Cariboo, Kamloops and Nelson regions	Virus and egg parasitism contributed to a collapse in the Nelson Region, but light or moderate defoliation occurred in 40 infestations totalling 13 350 ha near Quesnel, Shuswap, and Mabel lakes.
Western oak looper *Lambdina fiscellaria somniaria* (Hulst)	Garry oak	Saltspring Island	Very light defoliation of mature trees for the fifth successive year.
Western tent caterpillar *Malacosoma californicum pluviale* (Packard)	Red alder Willows Trembling aspen	Prince Rupert Region, Vancouver Island, Lower Mainland	Populations have declined. The major area was 900 ha defoliated north of Terrace.

Pacific and Yukon Region

Insect or Disease	Host(s)	Location	Remarks
Winter moth *Operophtera brumata* (L.)	Deciduous species	Southern Vancouver Island	Widespread light-to-severe defoliation in the Victoria area. Introduced larval parasites have become established with 47% of the winter moth parasitized. At Duncan, where the first collections were made in 1983, populations expanded and lightly defoliated Garry oak and fruit trees. At Nanaimo, moths were detected for the first time.

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